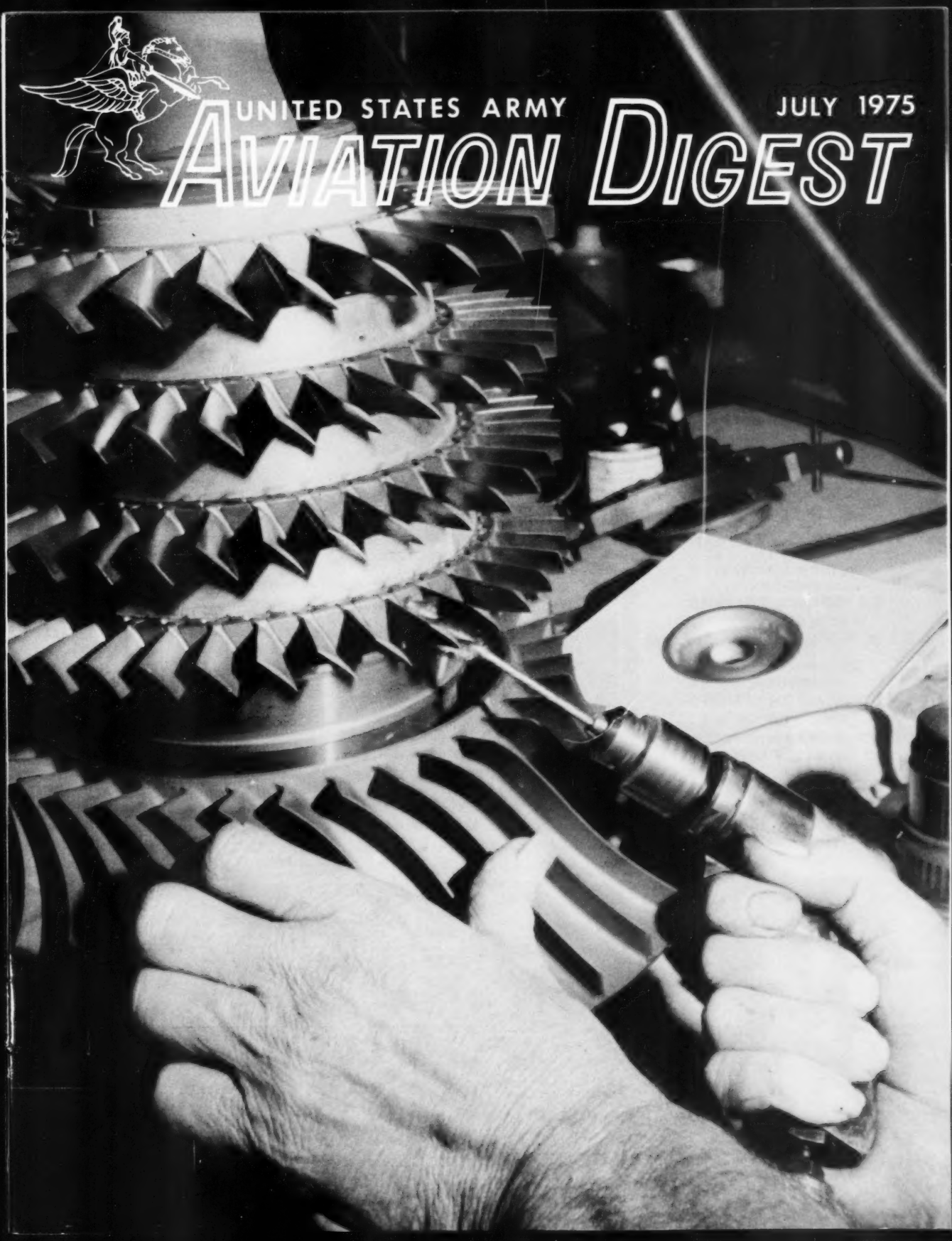

UNITED STATES ARMY

# AVIATION DIGEST

JULY 1975

# UNITED STATES ARMY AVIATION DIGEST

JULY 1975 VOLUME 21 NUMBER 7


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MG William J. Maddox Jr.
COMMANDER
U. S. ARMY AVIATION CENTER
A major activity of the
U. S. Army Training and Doctrine Command

COL Norman W. Paulson
COMMANDER
U. S. ARMY AGENCY FOR AVIATION SAFETY
A major activity of the
Inspector General and Auditor General
of the U. S. Army

Richard K. Tierney
EDITOR
U. S. ARMY AVIATION DIGEST


**ABOUT THE COVER**

"If It Ain't Broke—Don't Fix It," beginning on page 1 takes a look at new concepts in Army aviation logistics. The thrust is to eliminate preventative maintenance that fails to prevent


The mission of the U. S. ARMY AVIATION DIGEST is to provide information of an operational or functional nature concerning safety and aircraft accident prevention, training, maintenance, operations, research and development, aviation medicine and other related data.

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# IF IT AIN'T BROKE— DON'T FIX IT

**Joseph P. Cribbins**

Special Assistant
For Aviation Logistics
Deputy Chief of Staff
For Logistics
Department of the Army

THE TITLE OF this article represents exactly what we have frequently found out the hard way in our efforts to improve logistic support and operational readiness for Army helicopters.

During the past decade we have gained valuable experience, especially in the Republic of Vietnam, on how to increase aircraft operational readiness and utilization in flying hours without significantly increasing resource requirements. Today with austere budgets and reduced logistics spaces it has become even more evident that we must go much further.

Policy, practices and procedures must be revised to incorporate the lessons we have learned into the Army aviation program and we must look elsewhere for new concepts. We must also recognize that in a mid-intensity (high threat) conflict enemy action will result in a far greater impact on Army helicopter attrition rates, crash/battle damage losses and losses of supporting supplies and equipment. However, I do not believe that those basic concepts, practices and procedures we initiated largely as a result of experience in Vietnam will require any radical changes.

As I see it, a mid-intensity war will increase logistic requirements quantitatively and could require some changes in techniques being used depending upon when, where and how the war is being fought, e.g., increased aircraft attrition rates could result in much greater use of cannibalization.

I now will get into the chronology of events that have driven Army aviation logistics toward new concepts which either exist, are being tested, or are being implemented because they promise a significant payoff. The first major change directly relates to the title and is known as

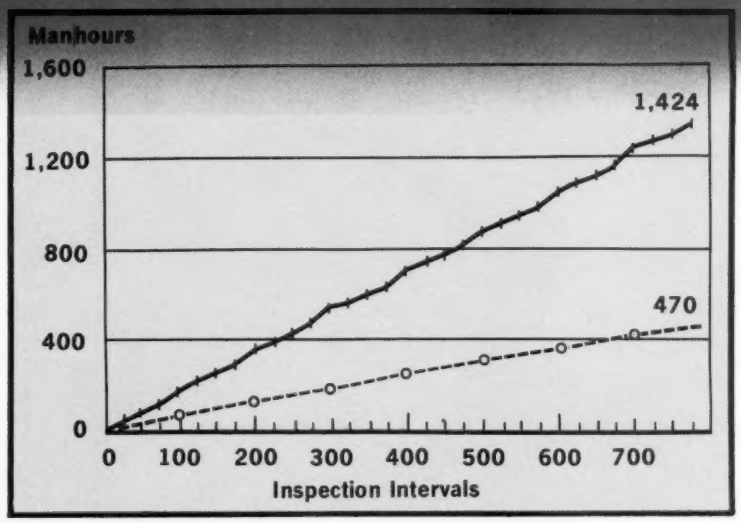
**Project INSPECT**

The Army has known for a long time that we have been performing too much maintenance on Army helicopters. However, about the time we began to do something about this problem, we became so committed to Vietnam that it was neither practicable nor wise to make any major changes in our scheduled inspection systems. But, there was one exception to this.

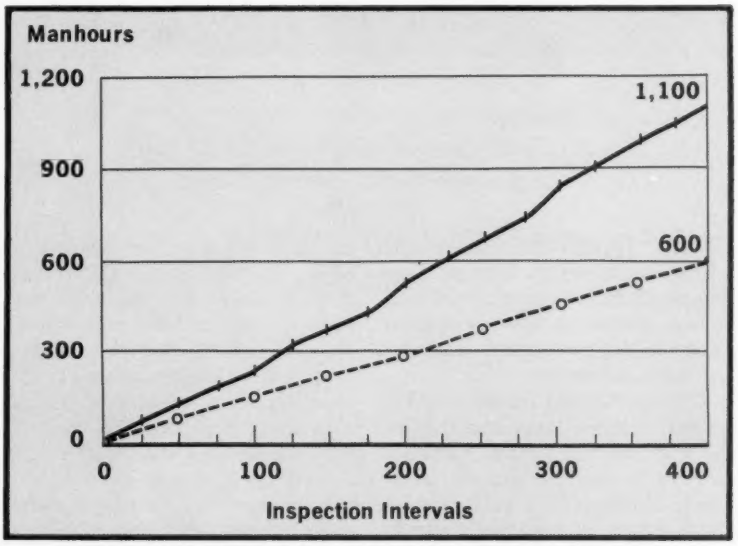
In 1966, when the requirement for training aviators at Fort Rucker was rapidly escalating, the Army approved the implementation of the Tailored Inspection Maintenance System (TIMS) at the U.S. Army Aviation School. TIMS revised scheduled inspections to provide a greater number of

operational aircraft and increased flying hours for the training fleet. For example, UH-1 Huey operational readiness rates increased from about 55 percent to 80 to 85 percent using the TIMS concept. Basically the TIMS concept phases scheduled aircraft maintenance to reduce the longer periods of downtime due to intermediate and periodic scheduled inspections so that more aircraft are ready on the flight line when needed for training. TIMS was implemented in a time of great need to provide more operationally ready aircraft at Fort Rucker. We intended to test the TIMS concept in the field in Vietnam but were overtaken by the Tet Offensive. However, we have pursued the idea and now are engaged in testing a concept which goes much further than the phased inspection concept used by TIMS.

In March 1971 the U.S. Army Air Mobility Research and Development Laboratory (AMRDL) initiated a study to evaluate current aircraft maintenance scheduled inspections. This study became the basis for a major ongoing action to develop specific scheduled maintenance inspection schemes for Army aircraft by mission/design/series (MDS) and by individual components and engines within each MDS aircraft system. The principal objectives of Project INSPECT are to cut down the number and frequency of scheduled inspections and to inspect only those components where the inspector can detect some deterioration and/or potential failure can be seen or forecast—this is known as time to onset (T/os). In substance INSPECT becomes an On Condition Maintenance (OCM) concept for scheduled maintenance inspections in the field. OCM will be addressed later in the article. Three Huey companies (60 aircraft) belonging to the 101st Airborne Division (Air Assault) now are under test at Fort Campbell with another three Huey companies acting as control. The test and evaluation of results are scheduled for completion by the end of calendar year 1975. We also are testing one CH-47 Chinook company and one Huey company at Fort Hood and AVSCOM (U.S. Army Aviation Systems Command) is beginning to prepare INSPECT checklists for OH-58 Kiowa and AH-1G HueyCobra helicopters.




PROJECT INSPECT VS STANDARD SYSTEM




PROJECT INSPECT VS STANDARD SYSTEM

We anticipate two major payoffs from Project INSPECT. First, our experience in testing the INSPECT concept to date indicates there will be a significant reduction in scheduled maintenance manhours, e.g., about 67 percent for the Huey every 800 flying hours and

45 percent for the Chinook every 400 flying hours. Under INSPECT the 800 hours for the Huey and 400 hours for the Chinook represent a complete inspection cycle for each aircraft system.

Second (and this is an unknown but could be of even more importance than the first payoff) will be the reduction in maintenance that so often results from over-maintaining aircraft—and other equipment too. Too much maintenance usually results in man-made or man-induced maintenance, sometimes called *Tinkeritis*. When this occurs, Murphy's Law takes over—"whatever can go wrong does go wrong," and a perfectly good piece of hardware becomes a candidate for the maintenance shop—*If It Ain't Broke—Don't Fit It!*

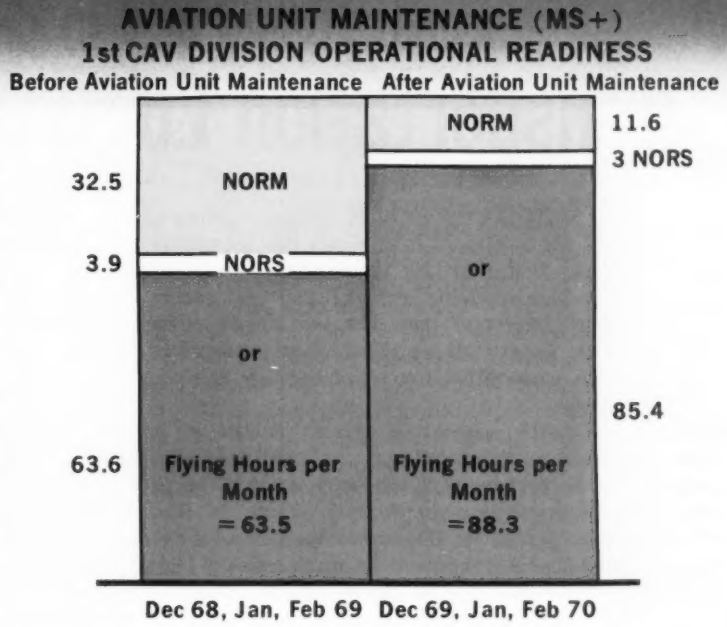
Be assured that we are not attacking the preventive maintenance concept. We are examining in detail inspection, requirements that do not prevent or forecast failure and too frequently cause the very maintenance we are trying to prevent.

The next major action now underway is resulting in significant changes in the

**Aviation Maintenance Structure**

Early in the days of Vietnam we found that helicopter units limited to performing organizational maintenance could not attain the operational readiness or flying hours required to perform combat missions. Accordingly, for separate company-sized units we first attached and later integrated a direct support (DS) maintenance detachment into the unit providing the capability to perform 60 to 70 percent of the DS work. An example of the effectiveness of this concept, which has become known as aviation unit maintenance (AVUM), was experienced in the 1st Cavalry Division.

Before AVUM the 1st Cavalry Division had 424 helicopters which were supported by unit organizational maintenance and backed up by four direct support companies. The 424 helicopters were attaining 64 percent operational readiness and an average of 63.5 flying hours per aircraft per month.




In 1969 AVUM was incorporated into 19 separate helicopter units in the 1st Cavalry Division by deactivating two of the four DS companies and adding 175 aircraft maintenance people to the division. After AVUM the 424 aircraft attained an average of 85 percent operational readiness and 88 flying hours per aircraft per month.

When one considers the improvement in combat readiness, the fact that acquisition value of the additional operationally ready aircraft was about $34 million and compares these with the cost for AVUM which was 175 maintenance people plus some additional costs for tools, the AVUM concept certainly has been cost effective for the Army and the taxpayer.

Our next major improvement action is known as

**Intermediate Maintenance**

At the same time we were moving a DS maintenance capability forward we also looked at general support (GS) maintenance requirements and capabilities in the rear. We found that we were asking GS maintenance to do too much component overhaul/repair in the field and as a result 75 to 80 percent of GS component/engine work required return to CONUS (Continental United States) depots. This was highlighted after the Tet Offensive in early 1968. We were really hard up for unserviceable T-53 HueyCobra engines to overhaul and return to Vietnam.

Our approach was to flush the Vietnam aviation logistics system by reducing in-country T-53 engine allowances to 114 engines or about seven days consumption (serviceable or unserviceable). Within a matter of weeks the Army Materiel Management Center (AMMC), U. S. Army Vietnam (USARV) located about 750 T-53 repairable engines. According to our doctrine

*Continued on page 11*

## Army Aviation

# Transportation Logistic Support

IN TODAY'S ERA of reduced funding and the ever increasing cost of materiel acquisition, it is necessary that we narrow our research objectives to assure ourselves that what we develop and introduce into the Army's inventory is, in fact, the best available and the most affordable. Having said that, I consider it even more important that what we do introduce is logistically supportable—for this is what we are talking about when we speak of the cost of ownership; and, although it is more difficult to totally identify, this cost is higher than the cost of acquisition by far.

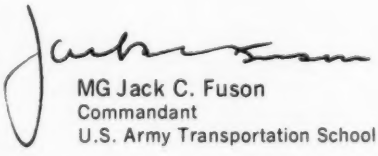
Logistic support of Army materiel in general, and Army aviation specifically, covers a "multitude of sins," so to speak. The U.S. Army Transportation School at Fort Eustis, VA, is acutely aware of the problems associated with total integrated logistic support of Army aviation. In this regard, a significant part of the total effort within the Transportation School is devoted to improving the materiel, organizational, doctrinal and training aspects of logistic support of Army aviation.

Two principal activities at Fort Eustis are involved in the combined effort of providing integrated aviation logistic support capabilities to the Army. First, within and under direction of the Deputy Commandant for Combat and Training Developments, concepts are evaluated and studies conducted to plot the future direction of the overall aviation logistics effort. On the materiel side, professional specialists examine these concepts and results of studies and determine the hardware needs in two specific areas—end item cargo helicopters required and ground support equipment area for all aviation assets within the Army. Finally, the melding of concepts and materiel is accomplished by integrating both into aviation doctrine and organizations.

The second activity of the Transportation School involved in aviation support is the Aviation Maintenance Training Department. Totally dedicated to aviation maintenance, this element annually conducts 310 courses of study in 16 military occupational specialty (MOS) areas.

The following articles are the joint effort of these two activities and are presented to inform you of just a few ongoing actions designed to operationally enhance Army aviation today and tomorrow.

I must stress the importance of resolving the problems we face today in order to achieve total integrated logistic support for Army aviation. It is a job that everyone can and must be concerned with from the system managers to instructors that train maintenance and flight crew personnel, as well as the individuals who operate and maintain the aircraft and its associated equipment in the field.



MG Jack C. Fuson
Commandant
U.S. Army Transportation School

# Ongoing Concepts and Studies*

CPT Roy P. Oler

DOCTRINAL CHANGES in the logistic support of Army aviation are not overnight occurrences but are the result of extensive study and evaluation conducted by various agencies. One such agency whose mission is to study and evaluate conceptual innovations is the Concepts and Studies (C&S) Division under the office of the Deputy Commandant for Combat and Training Developments.

The C&S Division has been active in several major study efforts concerning aviation maintenance and supply. Three such efforts are: $TAS_3$ (Transportation Aircraft Supply Support Structure), CONAM (Concept of Night Aircraft Maintenance), and the Army aircraft three-level maintenance system.

$TAS_3$ still in its conceptual stages of development, considers the possibility of total commodity orientation of aviation supply support. Current doctrine provides multiple channels through which aviation units receive aviation supply support. $TAS_3$ envisions a single source from which aviation units can obtain aviation-unique supplies of tools and clothing, major end items and repair parts. $TAS_3$ also considers a possible amalgamation of aviation maintenance and supply which is in consonance with the three-level maintenance system and would be in line with another logistics concept titled Commodity Oriented General Support (COGS). The COGS concept envisions a center type structure in lieu of a conventional battalion or group organization, located in the corps rear area and reporting to the corps support command (COSCOM) commander. The COGS center will be a commodity oriented amalgamation of general support category maintenance and supply. Even though this concept was designed for conventional materiel it has possibilities for application in the aviation field.

In a mid-intensity (high threat) European conflict, night aircraft maintenance will be required due to the high air defense threat and increased maintenance requirements. For the productivity and quality of night maintenance to duplicate daylight standards—doctrine, training and materiel must be updated.

A night aircraft maintenance field exercise recently was conducted by MASSTER (Modern Army Selected Systems Test, Evaluation and Review). During this field test, actual maintenance was performed on aircraft in the open under blackout conditions with the use of night vision devices and chemical illumination devices. The test was conducted to determine the actual feasibility of the concept and the results were surprisingly good. The report of the MASSTER test on CONAM now is being written.

The other project mentioned above and receiving top priority is the implementation of the three-level aircraft maintenance system. Under this system, the three levels of maintenance will be AVUM (aviation unit maintenance), AVIM (aviation intermediate maintenance) and depot.

AVUM will be located at the aviation unit and will have the capability of performing organizational maintenance and, when authorized, integrated direct support maintenance (IDSM).

The AVIM company will consist of an amalgamation of direct support and limited general support maintenance capabilities. The actual percent of general support maintenance the AVIM will be able to perform is yet undetermined.

The depot will continue to perform its depot level maintenance but also will perform that percent of general support maintenance that will be beyond AVIM companies' workloads or skill capabilities. The three-level system places a greater burden on the depot and provides a single intermediate step between the aviation unit and depot level support.

The Transportation School is in close contact with the other logistical schools which are studying and evaluating the total Army logistics picture. There is a constant exchange of ideas and philosophies in the areas of supply and maintenance so that the best aspects of each school's logistic concepts and doctrine can be adopted by the other schools.

*Followup to Logistical Support of Army Aircraft: Time for a change (June 75 DIGEST)

*Continued on page 17*

# the air combat directorate

Colonel Daniel B. Knight

WHAT IS AN Air Combat Directorate? Well, it's almost 50 folks, mostly field grade officers salted with some highly competent specialized civilians and young captains, located on a hilltop 20 minutes by car from the flagpole at MASSTER* Headquarters, West Fort Hood, TX.

We are a user test organization focused on the things, thoughts and organizations which combine on the battlefield just a few feet above the surface of the earth. We couldn't be in a better place to do this important work, and we couldn't be doing it at a more significant time in the modern history of our Army. Amidst the wreckage of the budget, in a POL (petroleum, oils and lubricants) desert, we are moving from oasis to oasis in an effort to relate the vague reality of a mid/high-intensity (high threat) battlefield to the harsh realities of mobility and firepower.

We share the Army's finest training facility with two great armored divisions, a corps support command, an air cavalry combat brigade and a full-scale corps headquarters. They are the "users" —we are the testers.

This past year we primarily have been occupied with the Air Cavalry Combat Brigade (ACCB) and the Cobra Weapons System. We continued the step-by-step appraisal, by field test, of the subordinate elements of the ACCB. After the previous years of dissecting and challenging the air cavalry troop and attack helicopter company, and living in the field with squadron level tactics and techniques, we crashed into the unforgiving wall of fiscal and fuel constraints and had to postpone our finale—a full field test of the ACCB.

Today, as the ACCB settles into new barracks, a new name—6th Cavalry Brigade (Air Combat)—and a new status of the first separate ACCB in our force structure, we are pinpointing our testers' lenses on the combat service support aspects of fighting this fast moving, tank-eating brigade over the width and breadth of a corps area of operations.

We will be looking at two important breakouts of combat service support—how and to what extent does the brigade support itself? And how does it interface or plug into the corps support command? We will be asking these critical questions: How does the ACCB maintain its identity in the computer which deals out repair parts when the outfit changes corps? How will the logistics system answer the tremendous challenges of providing aviation fuel and ammunition in the quantities, over the distances, and within the time constraints demanded by the full potential of this organization?

This test will support an evaluation by coordinated U.S. Army Training and Doctrine Command (TRADOC) agencies from which we will derive changes to the TOE (table of organization and equipment) in order to strike a balance between organic support and the management and communications facilities needed to coordinate with the corps area combat service support system. (The question is, how do we do it? Not can we do it?) We hope to provide a series of articles on the subjective appraisal of ACCB/CSS (combat service support) as we prepare for the field test.

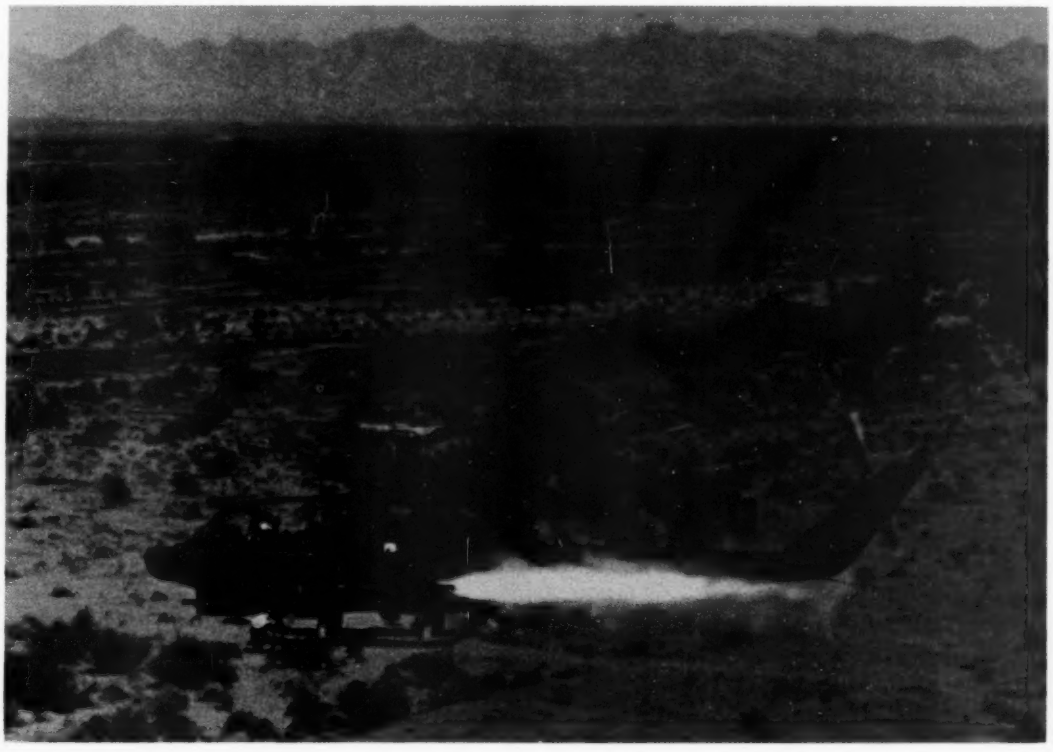
Our old friend, the AH-1 Huey-Cobra, has turned its many faces to us this past year. We conducted a followon evaluation of the Cobra/TOW (tube-launched, optically-tracked, wire-guided) firing capability. We went to China Lake and worked with free rocket delivery from a nap-of-the-earth environment. We tried some long range indirect fire with 2.75 inch rockets which had interesting positive results and took some preliminary steps toward testing a new

*Modern Army Selected Systems Test Evaluation and Review

A tactics series compiled from articles that have appeared in the AVIATION DIGEST is now available. These articles express the points of view of the combat arms center commanders and other Army leaders on airmobile and air assault tactics. To get your free copy write to Editor, U.S. ARMY AVIATION DIGEST, P.O. Drawer P, Fort Rucker, AL 36360

# headquarters, MASSTER

Director of the Air Combat Test Directorate
Headquarters, MASSTER



TOW Missile Firing

fire control system. This system will give the Cobra gunner a vertical and horizontal crosshair, automatically computed from laser sensed range and angular corrections from a relative wind sensing probe.

The research and development (R&D) community is striving to field fire control while it also works to improve and expand the uses of the 2.75 inch rocket. The goal is to field new options in warheads and fuzing on a rocket whose accuracy is greatly improved. The reduced size of the beaten zone resulting from 2.75 product improvement will be exploited by the dramatic improvement in predicting the center of impact through use of fire control.

Meanwhile, the Cobra has been improved with a bigger engine, strengthened power train and new tail rotor to increase its agility and maneuverability. We are field testing the new model as you read this article.

*Continued on page 22*

# His What Is Hot To Trot?

# His FARRP, Man!

**A view of current research and development efforts to improve upon combat refueling and rearming operations. In the recent past, crews frustratingly struggled to get a flight of helicopters back into the air to do further battle. The FARRP should help to get the job done safely in one-third the time**

Colonel Charles N. Allgood
U.S. Army (Retired)

Colonel George J. Merklinger
Deputy Commander, 13th COSCOM, Ft. Hood, TX

*DEVIL 6, THIS is Phantom 6, over."*

*"Phantom 6, Devil 6, go."*

*"O. K., Devil 6! Good show. We have Charley in a box. The slicks will be here with South Vietnamese troops in about an hour. In the meantime, we have to keep Charley buttoned up so you better keep up a fairly steady stream on him so he doesn't melt away. Your FARRP is hot to trot and B troop will be on station in about 5 minutes. It's two zero past now, so we will expect you back here by four five, over."*

*"This is Devil 6, roger that."*

*His "What" is hot to trot?*

His FARRP, man! You never heard of a FARRP? Well, neither did the rest of us while things were hot and heavy in Nam; but, if we could have listened in on such a conversation, we would have been privy to a plan of action which required getting a flight of five AH-1 HueyCobras back to a forward area refueling and rearming point (FARRP), refueling and rearming simultaneously, with engine and rotor blades turning, hot and back on target in a total elasped time of 25 minutes. Not bad!

This capability is not yet fully developed; however, in the mid-range timeframe (2 to 3 years), simultaneous hot refueling and rearming of helicopters in forward areas will be routinely accomplished in less than 15 minutes. Contrast this with the 45 to 60 minutes now spent on these tasks and you begin to get some idea of the importance of the innovative work now underway at the U.S. Army Logistics Center, Fort Lee, VA; Headquarters, Modern Army Selected Systems Test, Evaluation and Review (MASSTER), Fort Hood, TX; and the U.S. Army Materiel Command (AMC), Washington, DC. This improvement didn't just happen, however. What follows is a thumbnail history of the FARRP project that has resulted in this breakthrough.

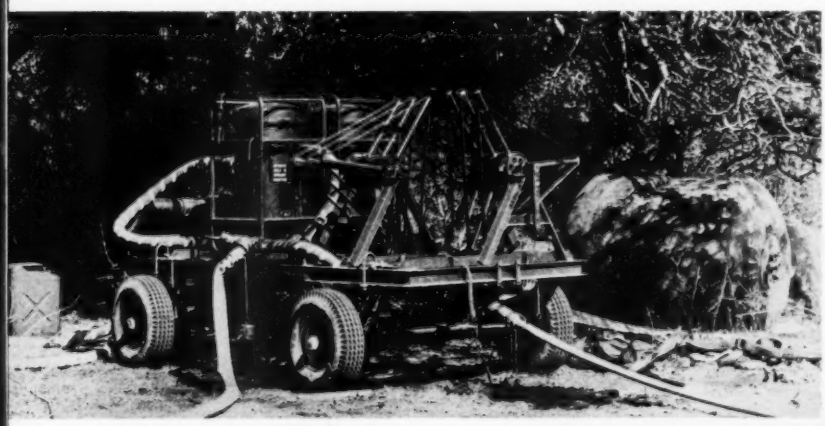
The renewed challenge of refueling and rearming helicopters in forward areas presented itself thousands of times in the Republic of Vietnam. Early in the conflict, it became evident that in certain modes, refueling and rearming in forward areas was required to increase time over target areas. A number of approaches to these tasks were devised through ingenuity, resourcefulness and hard work. During this period, we gave tacit recognition to the need for proper equipment to quickly establish and operate such a point; but we failed to establish uniform procedures, modify TOEs (tables of organization and equipment) or prepare requirement documents for equipment needs. Instead, each unit provided its own refueling and rearming capability as best it could with the means available to it. Sometimes these operations were small and maintained entirely by the aviation unit involved. In other instances, these points were established and operated entirely by support units which provided fuel and ammunition support to helicopters operating remotely from their normal base camp. In the absence of specialized equipment, ground crews were frequently limited in their ability to move materiel around the area by the sum of their physical strength. Rockets were individually hand-loaded, mini-gun ammunition was manhandled and laboriously hand-fed into drums. Much of this was accomplished by aircraft crews, adding to their fatigue from many hours of flying. Rearming was done in one location and refueling in another due to safety constraints. When simultaneous hot refueling and rearming was accom-

plished, it was out of necessity to meet urgent combat requirements. In general, these operations were altogether frustrating to the crews who struggled to get a flight of helicopters refueled, rearmed and back into the air.

In spite of our extensive Vietnam experience, we never answered the very obvious questions of who should establish, operate and resupply such a point, how should it be deployed and how should it be equipped? In recognition of these problems, the former Combat Developments Command (CDC) Supply Agency began a study entitled, "Forward Area Refueling and Rearming (FARR)." This study was restricted to the 1969-1970 timeframe and was based on procedures, organizations and equipment then available and did not address the resupply problem. Department of the Army (DA) approval was further qualified in that no additional personnel could be added to any TOE to perform this function. Just prior to publication of the FARR study, MASSTER's test of the Air Cavalry Combat Brigade (ACCB) and the TRICAP (Triple Capability) Division was conducted; and, as a result, new concepts of helicopter employment and support were proposed. In order to test these concepts, MASSTER was supported by AMC designed and assembled materiel which could be used to implement the new concepts. This joint effort resulted in MASSTER Test 1039 which was conducted in February 1973, and pointed the way to several decisions about FARRP operations. Pilots were not required to rearm or refuel their aircraft. A special team of 14 personnel performed all tasks required in the FARRP. Electric refueling equipment was used to eliminate the problem of starting small engines in cold climates. Ammunition was loaded a la M-16 magazines, in and out.

Provisions were made for night operations and air traffic control, and a small forklift was provided to move supplies and equipment within the FARRP.

When MASSTER published the report for Test 1039, it became evident that while some questions regarding FARRP operations were answered, it also pointed out new questions of concern. Who develops the doctrine of refueling/rearming, who performs the mission, which new equipment is best, how many people are needed, how do you resupply and how do you move the FARRP were some of the important questions. Also, how do you prove the safety of simultaneous hot refueling and rearming and who approves it? There was a



A FARRP similar to the one at left can be seen in the lower photo. Several Army helicopters cluster around it (arrow) to take on more fuel and ammunition

long list of such questions and challenges to be solved.

A series of working meetings were held during the remainder of 1973 with broad participation from the aviation and logistics communities. Headquarters, U. S. Army Aviation Systems Command, St. Louis, MO, was the focal point for materiel acquisition and coordinated AMC actions; the U.S. Army Logistics Center (USALOGC), acting for the U.S. Army Training and Doctrine Command, Fort Monroe, VA, took the lead in the development of concepts, doctrine and organizations. The AMC effort directly supported the advanced FARRP concept demonstrated in MASSTER Test 1039. Specialized equipment needs are being answered by AMC with delivery dates 2 to 3 years in the future. The USALOGC approach concentrated on the development of a FARRP capability utilizing currently available and supportable equipment for attack, assault and scout helicopter units. The recommended manning level by type unit is shown in the chart on this page. Personnel identified for FARRP operations are within TOE authorizations. The USALOGC noted a decline in aviation unit capability would occur when a FARRP is employed but made no attempt to quantify this decrement. DA accepted the Logistics Center report but directed that the FARRP be tested prior to final approval. The current timeframe FARRP will utilize equipment now available to our aviation units; the single exception is the materiels handling vehicle. The Logistics Center proposed the 6,000 pound rough terrain forklift as a FARRP vehicle, recognizing that an air transportable vehicle is not available at this time. DA directed that the prototype MJ-15 now being tested at MASSTER be considered current timeframe. Final selection of an aircraft weapons handling vehicle is still pending. Another major item of FARRP equipment required is a suitable refueler(s).

**Personnel Required For FARRP Operations**

**Headquarters and Headquarters Company**

| Position | Attack Helicopter Company | Assault Helicopter Battalion | Assault Helicopter Company | Air Cavalry Troop |
|---|---|---|---|---|
| FARRP Chief | 1 | 1 | 1 | 1 |
| Air Traffic Control Specialist | 1 | 1 | 1 | 1 |
| Aircraft Refuel Specialist | 3 | 8 | 4 | 2 |
| Aircraft Rearm Specialist | 10 | 8 | 4 | 8 |
| Equipment Operator | 1 | 1 | 1 | 1 |
| Ammunition Handler | 1 | 1 | 1 | 1 |
| TOTAL | 17 | 20 | 12 | 14 |

The Logistics Center is presently exercising an analytical model designed to assist in determining the impact on base area service and maintenance capabilities brought about by the periodic deployment of a FARRP. Input data provided by the Infantry, Armor and Artillery Schools is being utilized in this simulation.

The Logistics Center has contracted with MASSTER for a suitable field test of the current timeframe FARRP. Test FM 283 is to employ an air cavalry troop as the test unit and is scheduled to be conducted late in 1975. The results of these efforts should provide required information which will permit final DA action to make the current timeframe FARRP a reality.

Another effort in the Logistics Center is a doctrinal study known as ARRS (Aircraft Refueling and Rearming System). Recently completed, this study provides the framework for the identification of support requirements associated with FARRP operations. Once ARRS is married to the test results from MASSTER and the doctrinal development from the Logistics Center, a working FARRP will become a reality and "your FARRP is hot to trot" will become a familiar phrase.

**When he co-authored this article, Colonel Allgood was Chief of the Doctrine and Literature Division, Concepts and Doctrine Directorate at the U.S. Army Logistics Center, Ft. Lee, VA. While on active duty COL Allgood completed Artillery School, pilot training, Signal School Advanced Course, C&GSC and was a Master Aviator. He retired in March of this year**

**Colonel Merklinger was Liaison Officer to MASSTER, Ft. Hood, TX for the Logistics Center. The FARRP was a major project during this assignment. He has completed Ordnance Basic and Advanced courses, the Command and General Staff Course and the Army War College. In January of this year he was reassigned to Ft. Hood as Dep. CO of the 13th Corps Support Command**

*Continued from page 3*

they should have been repaired in Vietnam.

For many reasons beyond control of USARV, e.g., lack of repair parts, tools, MOS (military occupational specialty) skills and facilities, these engines were not repaired. Concurrently we established a three-times-a-week air pipeline with three C-141 airplane loads of serviceable engines going to Vietnam and three loads of unserviceable engines returning from Vietnam. From that time forward we rarely if ever had any depot level NORS (not operationally ready supply) for T-53 engines in Vietnam in spite of the fact that combat activity and flying hours were increasing.

As a result of the foregoing experiences, we ultimately arrived at the conclusion that with as much as 70 percent of DS maintenance moving forward into operating units and 75 to 80 percent of the GS requirement moving to depots in CONUS, we should realign our aviation maintenance into three levels of maintenance instead of four. The three-level maintenance concept was first implemented in July 1971 at Pyongtaek, Korea, when the U.S. Eighth Army amalgamated a DS and GS company into an intermediate maintenance company with a savings of more than 80 spaces and no impact on operational readiness.

The three-level aircraft maintenance concept is now U.S. Army doctrine and an intermediate level of maintenance is being established worldwide in lieu of separate DS and GS companies. Through the reduction in levels of maintenance we will gain more control and be better able to reduce unnecessary maintenance.

Having addressed the way we now plan to maintain aircraft at the operating unit and intermediate levels and our new maintenance structure, the next change of significance is a program known as

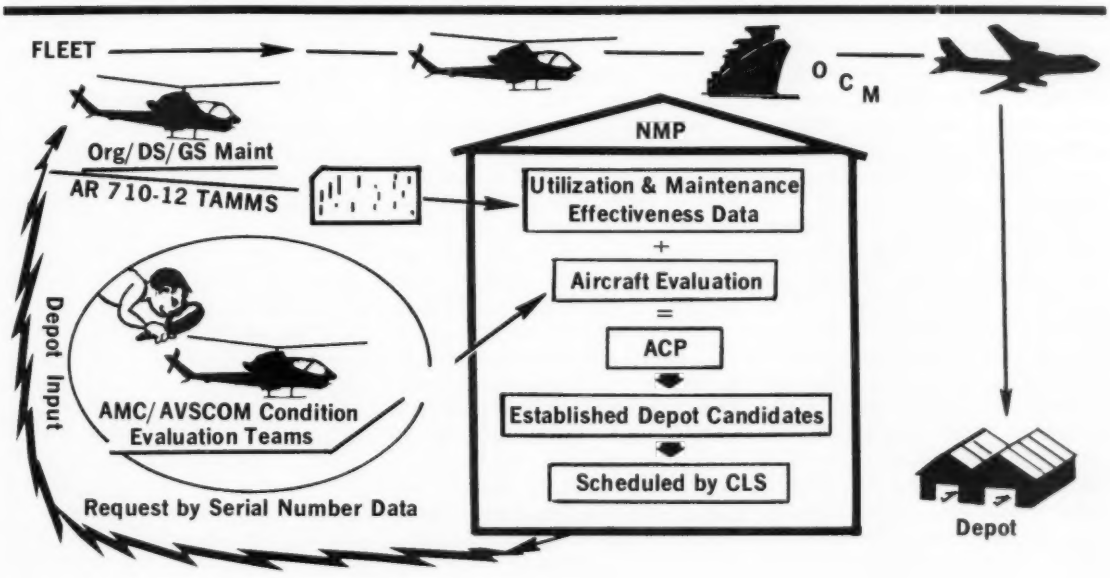
**On Condition Maintenance**

The Army found from experience with more than 4,000 helicopters in Vietnam that significant changes were required for overhauling aircraft at depot level. For example, when we first sent Army helicopters to Vietnam we believed that the Huey should be returned to CONUS for high-time depot overhaul when 2,200 hours or 30 months, whichever occurred first, had been accumulated.

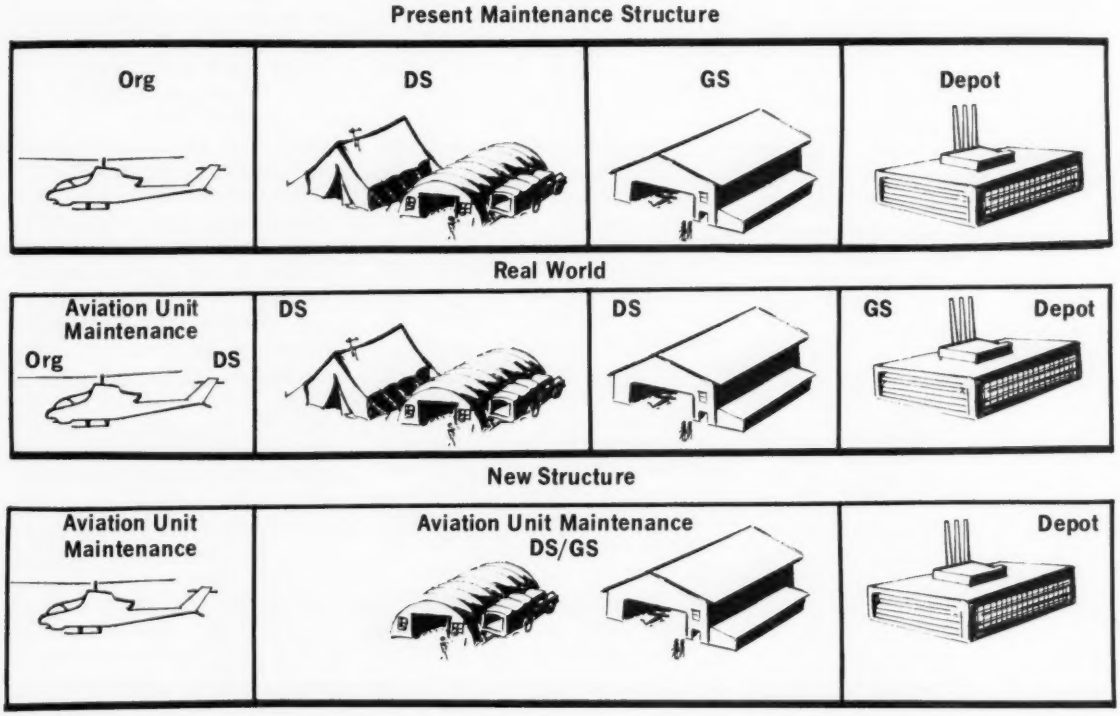
In 1969 we evaluated Hueys by serial number being returned to CONUS and found that more than 85 percent of them had been flown between 2,100 and 2,200 hours. This led to the conclusion that either USARV was expending too much effort in the field trying to attain 2,200 hours or depot maintenance criteria were too restrictive. We determined that the latter was the case and at the September 1969 Closed Loop Support Conference we extended depot maintenance intervals to 3,300 hours or 36 months.

With the new criteria we began achieving an average of 2,700 hours per Huey for those returned to depot. This was done without any appreciable problems in safety, reliability or maintainability and less than a 10 percent (200

**ON CONDITION MAINTENANCE**



## DS-GS AMALGAMATION




manhours) increase in depot maintenance work required.

Upon conclusion of our involvement in Vietnam we planned to return aircraft with their units. When the first unit arrived in CONUS it was found that all the good aircraft had been transferred out and "dogs" transferred in. Each needed some degree of depot maintenance.

Recognizing that it was reasonable for the people fighting the war in Vietnam to keep the best aircraft, we established a project called "EXTEND." Under this concept we returned all aircraft from Vietnam through the depot system, using revised depot maintenance work requirements (DMWR) and specifications. Our goal was to provide a safe, reliable, maintainable and customer acceptable aircraft at about one-third the depot overhaul cost and one-third the time in work.

With the Vietnam and Project EXTEND experience under our belts we began to question the validity of our policy to overhaul all Army aircraft every five years in peacetime. We worked with AMC (U.S. Army Materiel Command) and AVSCOM to establish new depot maintenance concepts, policies and practices. This has resulted in our current policy to overhaul aircraft based on condition rather than calendar time or flying hours. This we call OCM.

Under the OCM concept an aircraft condition evaluation (ACE) team inspects each aircraft annually by serial number. Aircraft are given a numerical rating by serial number and then are placed in priority sequence for call into depot maintenance "worst first." An example of results: Initially, the Army programed 588 Hueys for depot overhaul in fiscal year 1975. Using the OCM concept this number was reduced to 438 Hueys requiring depot overhaul or a reduction of 150 Hueys at about $95,000 each. This resulted in a $14.3 million cost avoidance in the overhaul program.

Here are a few personal observations and lessons learned during my 30 years in the aviation program, the last 15 of which have been spent in support of Army aviation logistics in the Pentagon.

Army aviation operations and logistics are peculiar to the Army and peculiar within the Army when compared to other commodities and equipment. For example, when it was found by USARV to be more effective and efficient to generally move maintenance to the rear for other commodities and equipment, we in aviation found

it better to move some DS maintenance forward as we have done under AVUM.

When we began the large scale buildup of aircraft in Vietnam, we envisioned doing a great deal of component overhaul/repair in-country. As pointed out above we found out that for many reasons this was not a viable concept. In substance we were asking our maintenance people in the field to do more overhaul/repair work than could be reasonably accomplished in a combat environment.

I want to add here that this was no fault of our Army aviation people in Vietnam. I have nothing but the greatest admiration and praise for the aircraft operations and maintenance people in Vietnam who lived and worked in an extremely difficult climate, in combat, often defending perimeters while maintaining aircraft—yet attaining higher operational readiness rates and flying hours than we had ever believed possible with current state-of-the-art helicopters.

To compensate for our inability to support forward area bit-and-piece repair parts maintenance we used air transport which significantly reduced pipelines and dollar inventories of high-value critical engines, components and repair parts while increasing combat effectiveness in the field.

Taking our aviation logistics experiences from Vietnam and applying them to peacetime is now resulting in major improvements in aviation logistics at reduced costs.

We also are finding it highly profitable to use airline maintenance concepts which are completely oriented on the title of this article, "If It Ain't Broke—Don't Fix It." Airline maintenance concepts which we are now beginning to use in the Army are outlined as follows:

**Hard Times**—A Hard Time engine or component is one that must be removed and overhauled or salvaged after a specific number of flying hours or calendar time. Comparable terms in the Army are—times between overhaul (TBO) or finite life. Examples are: Army aircraft engines which have a TBO based on flying hours and some rotor blades which have a finite operating life. Spark plugs in your automobile are another example. If you decide to replace them every 10,000 miles they are Hard Time.

**Mr. Cribbins wears two hats. He is the Special Assistant to DCSLOG for Aviation Logistics and Chief, Aviation Logistics Office, ODCSLOG, Headquarters, DA**

**On Condition Maintenance**—OCM is exactly as stated; maintenance is performed based on condition of the item rather than operating hours or calendar time. An example of OCM has been given for Army aircraft. Again—using the spark plug—if you periodically inspect plugs and clean and readjust them based on inspection you are in substitute treating the spark plug as an OCM item.

**Condition Monitoring**—This is a system of leaving well enough alone. If it works let it continue to work. The instruments in a helicopter are an example. Through visual observation without the necessity of periodic inspection or removal you let them work as long as they continue to work. For spark plugs in your car; if you never change them until there is some evidence other than inspection that they are malfunctioning—then you are using a Condition Monitoring system.

Not too long ago the airlines had from 40 to 50 percent of aircraft components designated as Hard Time and the remainder broken into On Condition or Condition Monitoring. New aircraft such as the 747, DC-10, L-1011 now have about 5 percent or less Hard Time, about 30 percent On Condition and the remainder of the components are Condition Monitored. This is the kind of progress we in Army aviation must emulate.

In my view, too frequently we have been highlighting the dissimilarities between commercial airlines and other operators and the military services instead of taking advantage of those things that are alike. To achieve this we are working closely with the Aerospace Industries Association, the Air Transport Association, Helicopter Association of America, the airlines and the manufacturers of commercial aircraft—as well as our own Army Aviation Association and American Helicopter Society.

As a final note:

- Progress in changing the way we do things has for the most part been the result of necessity; i.e., yesterday's emergency when it worked has become today's norm. Progress in accomplishment has been realized through the dedication and esprit de corps of the people who operate and maintain Army aircraft.
- We are placing the responsibilities and capabilities for aircraft maintenance where it can be done most effectively and efficiently.
- We can't stop now. For the future, looking at austere budgets and limited logistic resources and people, we must of necessity keep progressing toward better and more economical aviation logistic support.
- We must weed out those preventive maintenance requirements that don't prevent anything. ***If it Ain't Broke—Don't Fix It.***

# Save a Life - YOURS

## Or—You're Not Nutty If You Hear Your Machine Talking To You

**Colonel Howard J. Tuggey**
**Mr. Floyd Trudeau**
Corpus Christi Army Depot
Corpus Christi, TX

**Art by Mr. Juan Cobarruvias**

U. S. ARMY AVIATION DIGEST

ONE OF THE MOST important people in your life is you. Sure, you may place the wife and kids ahead of yourself, but you are very important to them also. If they knew some of the chances you take you'd be in BIG TROUBLE.

Some folks think that flying is hazardous and they may be right if you are in the kind of unit that has careless maintenance and doesn't believe in good safety practices.

Every week the U.S. Army Agency for Aviation Safety, Ft. Rucker, publishes a list of the aircraft accidents, incidents, forced landings and precautionary landings. It does this so that all pilots will see some of the mistakes being made by others and take heed. The system is working but we still need more pluses in our favor to assure our families that they need not worry.

A few years ago an instructor said that one way to keep out of trouble was to *listen to the machine*. He maintained that any helicopter he flew talked to him. He was—and *is*—absolutely right. The average citizen does not understand the language, but most pilots have heard a helicopter talking. It isn't enough to know the language, you must *pay attention*. When the machine complains of an ache or pain you had better see that it gets doctored, or one day it will die quite suddenly and may not be on the ground when it happens.

We at the Corpus Christi Army Depot (CCAD)—the new name for U.S. Army Aeronautical Depot Maintenance Center (ARADMAC) as of 1 July 1974—very seldom get to fly a machine that doesn't have a complaint. Naturally, when an aircraft is disassembled and each component inspected, reworked or replaced, it requires a lot of maintenance actions to get everything back together and properly coordinated. Pressures, temperatures, tachometer readings, radios, compass all need to be adjusted. At the CCAD flight line we accomplish most of these adjustments on the *tie down*.

When an aircraft comes off the assembly line, it is painted and sent to the flight line. It is dry (no fuel or oil) when the crewchief is assigned. The hydraulic systems are serviced and the oil tank and numerous other oil reservoirs are serviced and checked for leaks.

The aircraft then goes to the initial fueling, an important step. As each five gallons of fuel is pumped into the tanks the aircraft gauge is checked. In this manner the pilot is assured that the fuel indicated on his aircraft gauge is exactly the amount he has in the tanks.

Next the aircraft is weighed to determine its center of gravity, a must with all aircraft, and then sent to the tie down.

The tie down is a specially-built, heavy-duty turnbuckle which is fastened at one end to the aircraft lift point and at the other end to a heavy-duty hook in the ground. The hook has been tested to 10 times the stress the aircraft could put on it.

On this tie down the aircraft is started. While it is running, all the gauges, the engine and the transmission (in fact everything but the rotor blades) can be adjusted under simulated flight conditions. More than 100 items are on the checklist the crewchief and pilot must use. Here the CCAD test pilot first listens to the machine "talking" and gets familiar with the aircraft he will later test fly. The pilot and the crewchief together work out most of the problems on the tie down.

The crewchief listens to the engine during start and again on shutdown. Any looseness or rubbing in the engine turbines can be detected this way. The hydraulics system or systems, as the case may be, have sounds of their own. When something is wrong, the system sound is different.

YOU SEE BOSS... MY POWER TRAIN ACHES! MY HYDRAULIC PRESSURE ISN'T WHAT IT SHOULD BE AND...
KEEP YOUR COOL! I'LL HAVE DOC TAKE A LOOK AT YOU.

The blades, the electrical inverters all have their own sounds, and when they are well you can hear them humming their individual tunes. An unusual sound in one of the systems does not necessarily mean danger. It merely says better check this one out. So, you see, the aircraft does have the ability to tell you when it needs help.

There certainly have been plenty

of aircraft accidents and near accidents wherein the aircraft was shouting for attention but the pilot didn't recognize it.

In particular, a pilot should pay attention to the sound and feel of the main and tail rotor blades. One pilot, 30 minutes out on an hour cross-country flight, felt a vertical vibration much like you would get if one of your automobile tires suddenly got a lump in it. The vibration increased in intensity and when he landed 30 minutes later, he was only a few minutes away from a major catastrophe. A bearing in the control system had failed and had nearly worn the control out as it shouted, "*fix me!*" Other pilots have not been so lucky.

Any increase in the vibrations level of an aircraft while it is in flight is cause for concern. Another pilot heard a loud buzzing coming from the engine area. This was accompanied by a vibration and a change in the engine instruments. Then everything seemed to settle down and the pilot elected to continue his flight. Any other pilot might have done the same thing but most certainly he should have been alert for an engine failure. This one wasn't alert and crashed into the trees.

A good drill in flight is to fly on a calm day and then try a windy day with downwind, crosswind and upwind flight to feel what the wind angle does to the tail rotor and helicopter vibrations in general. If you know how normal vibrations feel you can identify the unusual.

Flying is not dangerous if everyone does his job right. Don't depend on the other guy too much, though. He can make a mistake or overlook something. A thorough preflight, careful planning, a weather check, and your flight can be a joy.

As you cruise along, remember that you are only a part of the effort that keeps your flight in the air. If you developed cramps or some other illness, you would land and seek medical attention. If your aircraft develops a problem, and well it might since it is doing most of the work, it will complain in some manner. It will get the shakes or start humming a new tune. Listen to it, give it the tender, loving care it needs and it in return will give you many hours of safe, comfortable flying to enjoy.

At the Corpus Christi Army Depot, the helicopter hospital, there are about 4,000 "doctors," all working to make your aircraft well and happy. A large number of these "doctors" are specialists and do not work with the entire aircraft. The engine shop, the transmission shop, the hydraulics shop, etc., each have test equipment peculiar to their operations.

The mechanics actually use a stethoscope in some of these areas. They all listen and feel for unusual sounds or vibrations to determine if their individual component is operating correctly. Then, when all the components with their sounds and vibrations are put together, like musical instruments in an orchestra, they will play sweet music for you. If one of the instruments in an orchestra should sound a discordant note, your ear would immediately pick it out. So it should be when one of the aircraft components sounds a discordant note. You are the conductor of the helicopter sounds, do something about it.

**Colonel Howard J. Tuggey, Master Army Aviator, is Director for Maintenance, Corpus Christi Army Depot. Mr. Floyd Trudeau is a former Army aviator assigned as a depot test pilot. Both COL Tuggey and Mr. Trudeau test fly Army, Navy, Marine and Air Force helicopters repaired and overhauled at Corpus Christi**

*Continued from page 5*

# Aviation Tool Control Program

## More Than Just An Accounting Procedure

CPT Robert B. McConkey

NO ONE IN THE aircraft maintenance business wants to find himself responsible for a total crash or seriously damaged aircraft. It is a matter of pride that becomes more apparent in this business.

A tool program has been designed so that the chance of the repairman being involved in this type accident, with injuries, death or costly damage, will be rather impossible. This is the current "Army Aviation Tool Control Program," which provides for a toolbox that can be completely inventoried in 5 seconds. In effect—open the box and look at it. Gone will be those time-consuming, costly periodic layout of tools so the platoon sergeants or supervisors can check you out. He—or his representative—will do this twice a day. The repairman will check the box out when he starts the job and again when it is completed. If a tool has been misplaced the aircraft will be marked with a red "X" until it is found. The following is how it all happened:

A key part of integrated logistic support is the necessity to conserve and maintain assets and eliminate waste. A problem that has plagued Army aviation for years is the absence of an effective tool control program. This deficiency contributes to many undesirable circumstances—foreign object damage (FOD), lost and stolen tools and a less than totally professional approach to maintenance. This new tool control program is designed to reduce if not eliminate these deficiencies.

Regardless of the service—Army, Navy, Air Force, or Marine Corps, FOD is a significant factor in loss of aircraft and human life. Aside from the fact that both represent items of limited supply, aircraft represent high dollar investments and, of course, there is no value high enough to compensate for a human life or maimed body. Unfortunately, and all too frequently, handtools are the FOD culprits that bring about these devastating losses.

What has FOD cost the Army? Information provided by the U.S. Army Agency for Aviation Safety at Fort Rucker states that during the period 1 July 1968 through 31 December 1974, there were 42 accidents and/or incidents where tools were determined to be a direct cause. These accidents resulted in seven fatalities, nine injuries and more than 1.5 million dollars in damage to aircraft. Based on data provided by the U.S. Army Aviation Systems Command, St. Louis, MO, of the 26,207 Army gas turbine engines returned to the depot for repair during the period 1 January 1968 through 30 June 1974, 28 percent were a direct result of FOD. Total cost to rebuild these engines was nearly 144 million dollars.

Impressive numbers? Yes! A great majority probably were not a direct result of misplaced handtools; however, a significant amount of this damage was perhaps caused by tools carelessly unaccounted for. Carelessness with tools leads to a degree of carelessness with other things such as old parts, nuts and bolts, etc., that also significantly contribute to the total FOD problem.

Why do tools get misplaced? Army mechanics are as good as any. What, then, is the problem? A major part is that the mechanic is not certain that all of his tools have been retrieved and are back in the box when he has completed his job. The toolbox currently in use does not lend itself to rapid accountability and is inventoried only periodically by the time-honored layout method. This is time consuming and serves primarily as a tool accounting procedure rather than a tool control measure. Proper tool control is needed to prevent FOD.

The Navy and Air Force have developed toolboxes that can be inventoried in seconds. More important, if the mechanic or supervisor finds a tool missing after working on an aircraft, the aircraft can immediately be grounded until the tool is accounted for. It merits repeating that this type kit permits a mechanic to detect a missing tool in a matter of seconds. The boxes (see figures) are designed with a specific space for every tool. This pro-

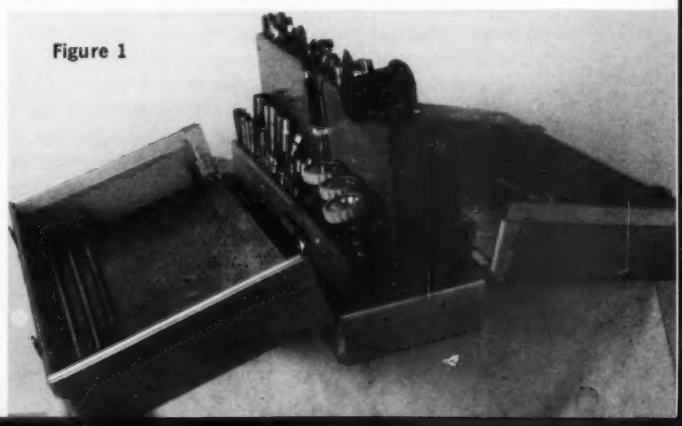


Figure 1

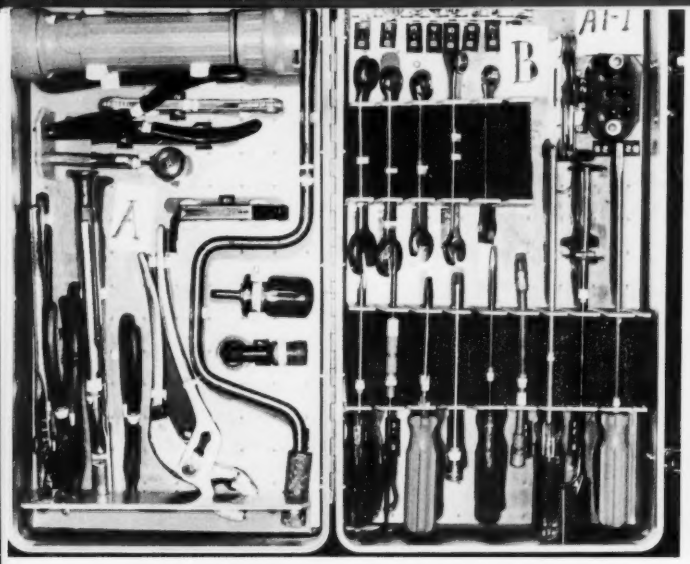


Figure 2

Figure 3

vides the mechanic ready access to the right tool at the right time as well as a rapid inventory.

"Composite toolkits" provide sufficient tools for maintenance personnel to perform 80 to 90 percent of their assigned tasks. The seldom-used tools are removed and stored at an issuing point or toolcrib. Rapid inventory is provided by profile slots cut into polyether charcoal foam or slotted plastic trays with a slot for each tool (see figure 1). Smaller briefcase size kits also are available for specialized maintenance such as electrical, hydraulics, and sheet metal repairs—each designed with sufficient tools for the specialist to complete his tasks (see figure 2). The Navy toolboxes shown in figure 3 have been improved by recessing the latches and handles. This provides not only a saving in space but also prevents damage to these parts.

Tool control also can reduce the funds expended on replacement tools. Navy furnished data indicates a savings of about 60 percent in tool outfitting and replacement costs for those units operating under the new system. The Air Force has estimated that their composite toolkit program reduced the number of tools required by an aircraft wing as much as 75 percent. It also was estimated that the average toolkit weight per man was reduced from 62 to 15 pounds. The Army tool program may or may not be able to match these results. The working conditions under which maintenance is performed vary greatly and in fixed shop arrangements, savings can be achieved that cannot be applied to field type organizations and facilities.

As a result of recommendations by personnel engaged in the concept of night aircraft maintenance (CONAM) test, a tool carrying vest is being formulated. It was determined that having toolboxes or loose tools on the work areas of the aircraft presents a serious safety hazard. This vest will be designed to hold sufficient tools for the repairman to complete his tasks. Pockets will be placed on the vest for small hardware items and most important—a FOD pocket for safety wire, nuts, washers, etc., that need removal from the aircraft. Figure 4 shows the basic concept.

Based on the percentage ratios that the other services have realized in their programs and on the best information available, indications are that the Army can significantly reduce its tool outfitting and replacement costs by implementing an Army tool control program.

We can only speculate on the savings in lives and the reduction in injuries, accidents and FOD to aircraft. Without doubt, the cost of tool replacements alone can be a significant factor.

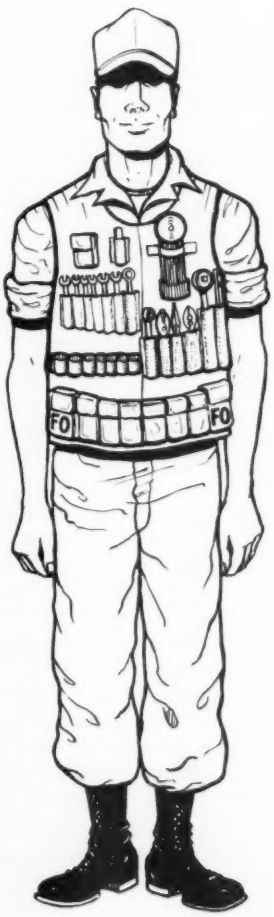



Figure 4

The Transportation School has established a tool control program for aviation and has initiated an effort to bring about an Army tool control program.

The basic aim of the Army tool control program will be to provide a system of tool identification, issue, storage and control by the following means:

- The development of standardized tool lists for each type aircraft or vehicle as the case may be.
- The development of standardized toolbox layouts for each list as a starting point for units to work with.
- The development of better control and procurement program for replacement tools.
- The investigation of new approaches to standardization in the overall system, the followup tool requirements for all types of maintenance activities in order to keep tool lists current.

Although this article has focused on the aircraft maintenance application, the benefits that can be realized in maintenance of all Army equipment appear evident and significant. The savings in tool replacement costs alone dictate that a program designed to address safety, tool control and tool accountability would apply throughout the entire Army maintenance structure.

# Ground Support Equipment

## Difficult To Live With—Impossible To Live Without

Mr. Clifford R. Edwards

A MOST SIGNIFICANT materiel development area under the auspices of the Transportation School is that of the improvement of aviation ground support equipment (GSE). In October 1974 a program was initiated to identify the equipment in the system and make a list of equipment needed in units by type aircraft.

Several aviation project officers have been engaged in this investigation which should be completed this summer. In response to requirements of the Department of the Army (DA) joint study group for aviation GSE, the U.S. Army Aviation Systems Command had compiled a list of all items of GSE that have been procured. When both of these efforts are completed the two lists will be merged to identify those items that will meet the requirements of aviation units.

The Transportation School also has recommended two additional efforts that will correct the maintenance and supply support problems in GSE. First, that a military occupational specialty (MOS) for a GSE repairman be added to the 67 CMF (career management field) and individuals be school trained on aviation support equipment. Second, a GSE repair section has been incorporated into the aviation intermediate maintenance (AVIM) table of organization and equipment (TOE) now under development. This will provide a single support unit for GSE where parts may be made available to provide rapid repair and return to service. It also will provide a point from which logistic support data may be gathered to procure spare parts to maintain adequate support levels. These efforts will enhance the logistic support of Army aviation, provide a maintenance capability not previously available and increase the number of aircraft available to support the Army's mission.

All items of GSE will be looked at for possible improvement. Much of the current Army equipment is not designed to function in a field environment. Aviation units do not have the luxury of working from hardened surfaces all the time. Aircraft maintenance personnel have maintained and will continue to maintain aircraft wherever required to set up — including roads, fields, riverbeds and other unprepared areas.

Another significant problem being examined is the standardization of GSE undercarriage wheels and tires to improve mobility and permit interchangeability where possible. The proliferation of wheel and tire sizes on GSE has caused excess downtime of equipment.

Total completion of the GSE program is not definite. But problem areas are not as complex as they appear on the surface. A goal has been established to procure and issue the best GSE that can be developed. With all agencies coordinating their efforts to meet the challenge, the problem areas will be solved.

Providing users with equipment that will meet their operational needs on a continuous day-to-day basis cannot be accomplished until adequate maintenance support and supply support is made available. This fact was emphasized in a recent report on GSE equipment of a U.S. Army Training and Doctrine Command factfinding trip to Europe and Korea. Based on recommendations from this report, every effort is being made to get the logistics problem solved and the proper equipment in every TOE.

# Career Management Field 67

## A Progress Report

MAJ Collins J. Purchase

IN 1968 THE Department of Defense directed the armed services to develop new enlisted personnel management systems. After several years of labor on many different enlisted personnel programs, the final proposed Enlisted Personnel Management System (EPMS) became an approved reality on 23 August 1974.

The U.S. Army Military Personnel Center (USAMILPERCEN) immediately undertook the redesign of all the career management fields (CMF) under the newly created EPMS program. A major portion of the EPMS program at the Transportation School was the restructuring and redesign of CMF 67, Aviation Maintenance.

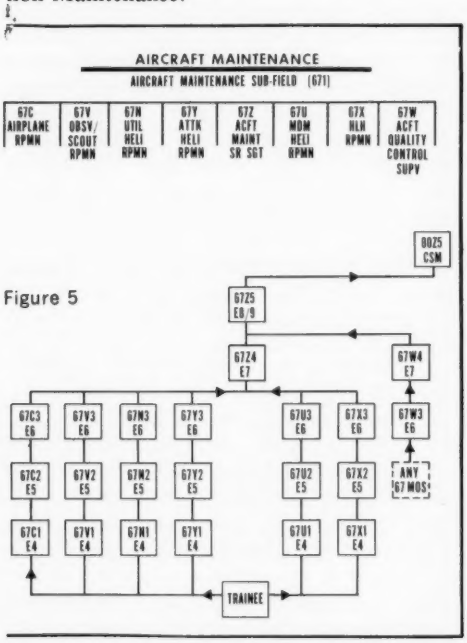



Figure 5

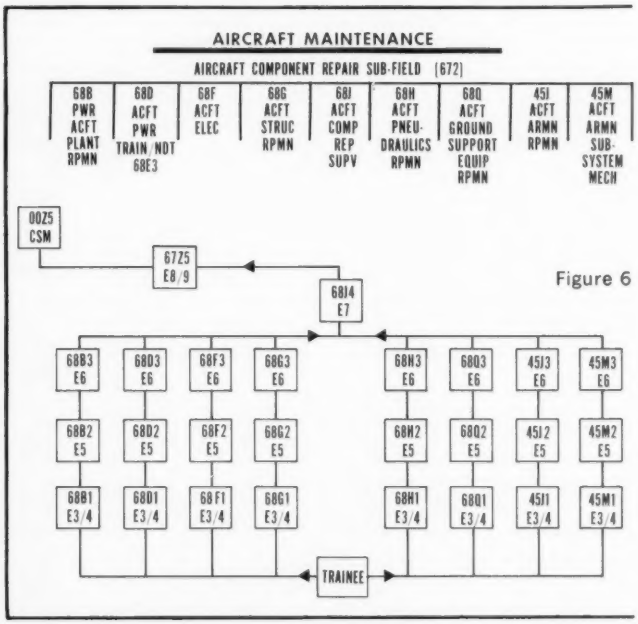



Figure 6

After considerable redesign, CMF 67 consists of two subfields, Aircraft Maintenance and Aircraft Component Repair, with 17 individual aviation maintenance military occupational specialties (MOSs). This redesign represents a reduction of seven from the present twenty aviation MOSs; includes one new MOS (68Q) created for Ground Support Equipment Repair; and two Aviation Armanent MOSs (45J and 45M) transferred from CMF 63, Mechanical Maintenance.

Figure 5 shows the proposed grade progression in the Aircraft Maintenance subfield. MOS 67B and 67C have been eliminated due to aircraft obsolesence and the remaining MOSs 67G and 67H consolidated into one MOS (67G) and retitled Airplane Repairman.

MOS 67V has been retitled Observation/Scout Helicopter Repairman. This MOS is projected to assume support responsibility of the Advanced Scout Helicopter (ASH) plus maintaining the current observation helicopters, the OH-6 Cayuse and OH-58 Kiowa.

MOS 67N, UH-1 Helicopter Repairman, has been retitled Utility Helicopter Repairman. This MOS will maintain the current utility helicopters (UH-1 Huey) and will support the Utility Tactical Transport Aircraft System (UTTAS) when introduced.

The AH-1G MOS 67Y designation has been changed to Attack Helicopter Repairman. MOS 67U has been changed from a CH-47 Helicopter Repairman to a Medium Helicopter Repairman. MOS 67X

will continue to maintain the CH-54 Crane and will assume the responsibility for the heavy lift helicopter when introduced into the system.

The duties of MOS 67F, Airplane Technical Inspector, and MOS 67W, Helicopter Technical Inspector, have been consolidated into one MOS and retitled Aircraft Quality Control Supervisor. The prime function will be to supervise quality control management programs which apply to both fixed and rotary wing aircraft. MOS 67Z, Aircraft Maintenance Senior Sergeant, remains the same.

Figure 6 shows the proposed MOS and grade progression in the Aircraft Component Repair subfield. The proposed changes under the EPMS program have been minor within the 68-series MOS. MOS 68B has been retitled Aircraft Powerplant Repairman. All duties associated with aircraft turbine powerplants, whether single or multiengine installation, have been consolidated in this MOS. An additional skill identified (ASI) will be assigned within the MOS for maintenance of reciprocating engines.

MOS 68E, Aircraft Rotor and Propeller Repairman, has been eliminated and its associated tasks redistributed. Rotor blade repair has been assigned to MOS 68G, Aircraft Structural Repairman; and propeller repair has been assigned to the Aircraft Powerplant Repairman as an ASI.

MOS 68D has been retitled Aircraft Power Train/NDT. Non-destructive testing constituted an appreciable workload and needed to be identified in the MOS title. MOS 68F, Aircraft Electrician, remains the same and MOS 68G is retitled Aircraft Structural Repairman to more align the title with duties performed.

A new MOS, 68J, Aircraft Component Repair Supervisor, has been created. All 68-series MOS will feed the 68J MOS with normal grade progression to the 67Z, E8/9 Aircraft Maintenance Senior Sergeant.

MOS 68H has been retitled Aircraft Pneudraulics Repairman to better identify job functions. A new MOS (68Q) has been created for repair of aircraft ground support equipment (GSE).

The Aircraft Armament MOS 45J, Aircraft Armament Repairman, and 45M, Aircraft Armament Sub-System Mechanic, have been moved from CMF 63, Mechanical Maintenance, to CMF 67. Throughout the careers of these MOS holders, their assignments fall within the aircraft maintenance field and are in a position to gain the required experience for promotion to the 68J and 67Z career MOSs for the aircraft maintenance CMF.

The newly redesigned MOS structure has been tailored to maintain the current aircraft inventory and assume the support responsibility of new aircraft as they are introduced into the system. The Transportation School now is developing implementation plans for the redesigned CMF 67. Classroom instruction under the redesigned program is scheduled for next April. Skill qualification tests (SQT) will replace the current MOS tests and will be administered for the first time in the period April to June 1977.

# One Facet of Reserve Component Training

## A Three-Phase Program

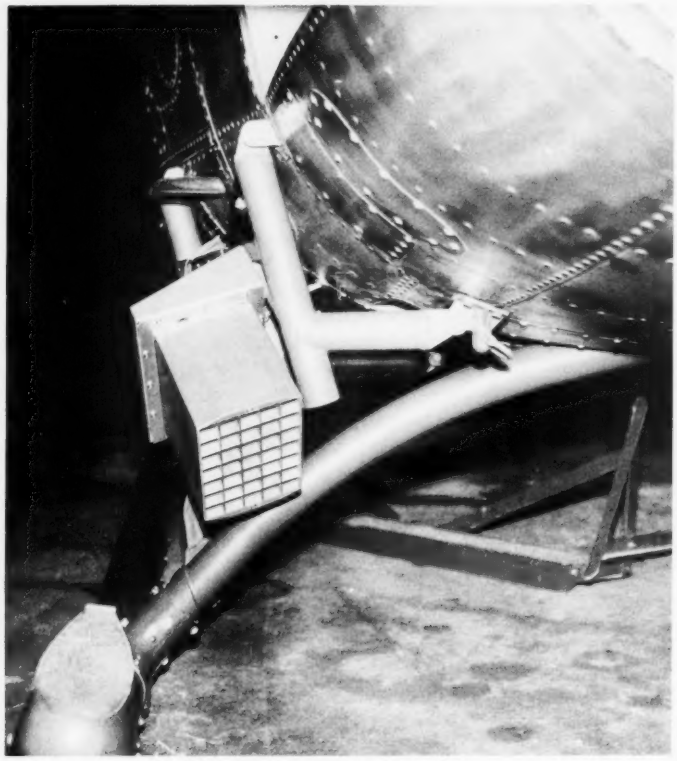
Mr. Jesse C. Cozart

APPROXIMATELY half of the Army's aviation resources are located in the Reserve components and training in support of these resources is a major concern at the U.S. Army Transportation School.

Total force is no longer a concept but a policy and readiness of aircraft maintenance resources, located within the Reserve component structure, is receiving training priority comparable to that of the active forces. In consideration of this requirement, the Transportation School is developing a training program for the Reserve components. The program consolidates a series of fragmented, piecemeal efforts to support aircraft maintenance training requirements for the Reserve components. The end product is a concise packet of programs of instructions, lesson plans and evaluations that will detail military occupational specialty (MOS) training for the 67- and 68-series MOS.

In the past the Transportation School has responded successfully to various requests for tailored training programs without the benefit of supporting resources. In March 1974 the Army Readiness Region VII commander recommended to U.S. Army Forces Command (FORSCOM) that the proponent service schools for aircraft maintenance training be tasked to develop special programs of instruction for selected aircraft maintenance MOSs. In June 1974 the Transportation School responded to this recommendation with a proposal for a three-phase, 14-month training program for MOS qualification. This program was later revised to a three-phase, 3-year program providing both MOS qualification and unit training, culminating in a modified Army training and evaluation program (ARTEP). Due to the existing funding constraints, this plan was not favorably considered.

*Continued on page 27*



details pertaining to the location and type of radar involved. This portion of the test was very useful to the continued development of radar warning devices.

The use of chaff ejected from a helicopter in flight coupled with maneuver patterns was examined as a technique for breaking the lock of a tracking radar. Sufficient success was achieved to warrant further development and testing. The varying altitudes and airspeeds of our helicopters present challenges in terms of location of chaff cartridges and the optimum direction from the aircraft for ejection. The test of mini-chaff indicated that, coupled with evasive maneuvers, chaff makes a significant contribution to preventing or breaking radar locks.

As part of the total MASSTER testing community, we also look at many other items of equipment. We are managing small tests on a variety of tire mounter-demounters,

Chaff Dispenser

Aircraft Cover

*Continued from page 7*

So, the ACCB thrives and is improving. The old faithful Cobra is getting a facelifting and new firepower punch and MASSTER's Air Combat Directorate is in a ringside seat troop testing the new concepts, hardware and organizations.

A full picture of the directorate's activities must include several tests which are not directly related to Cobra weapons or the ACCB.

We have just finished the Radar Warning Receiver Mini-Chaff Test which pitted two separate systems mounted in the UH-1H Huey against a variety of simulated threat radars. The idea is to tell the pilot he is under surveillance by radar and provide him with some

**Colonel Daniel B. Knight is a Senior Army Aviator and parachutist. He received a bachelor's degree from the Military Academy and a master's degree from USC. He is a graduate of the Infantry Officer's Advanced Course, the Command and General Staff College and the Army War College**

a 50-foot expandable shelter, a polyurethane cover for helicopter storage and the weapons engagement scoring system (WESS). WESS is an instrumentation system which will give us realtime readout of kills in two-sided field exercises. It uses lasers and is tied into other MASSTER instrumentation systems.

The future holds a multitude of fascinations: . . . how do we employ chaff rockets? Should field artillery have a chaff capability to "smoke" radars with a chaff cloud while air vehicles maneuver in, around or over the FEBA (forward edge of the battle area)? What supporting fires for suppression and destruction should be immediately available on call to the attack helicopter platoon while it engages a tank force? What weapons should the platoon have with it?

The combined arms challenge for establishment of an environment with acceptable risk to helicopters parallels that which we faced when adjusting infantry tactics to the machinegun. How do we fire and maneuver—over watch—to exploit the vulnerabilities of enemy ADA (air defense artillery) systems to destroy them or suppress them long enough to kill tanks and reposition? How can we reduce the increments of exposure time in the engagement sequence of an attack helicopter firing a TOW missile at a tank?

The tactics, techniques and equipment to facilitate handoff from scout to TOW Cobra may shorten the step from unmask to detection. Training, new equipment and better handoff can cut the time from detection to acquisition. Maneuver into launch constraints depends upon crew skill and what the target and terrain combination present. Time of flight is range dependent. (Should we *always* engage at maximum range—or should we try to get in close (terrain permitting) to reduce exposure time to ADA weapons?)

Recovery consists of remask and moving, concealed, out of a potential killing zone from artillery counter-helicopter fire.

One of the most important questions we face relates to realistic attrition rates for Army helicopters. With the introduction of WESS next year, we hope to test our helicopters and their tactics in combined arms arrays against aggressor forces armed with sophisticated air defense weapons. We need realtime kill readouts to realistically assess survivability, develop attrition rates and evaluate the relationships between losses and the contribution to the battle of our various types of helicopters.

We have two tests on the books which focus on survivability: the Attack Helicopter Instrumented Test (AHIT) and the Air/Ground Scout Integration Test (AGIT). AHIT is written but waiting for money and AGIT is in the early concept stage of preparation.

The Air Combat Directorate sums up to be a center of aviation thought which executes field tests with Soldiers under real life conditions. We tie past, present and future together through a constant dialogue with service schools, the R&D community and other test agencies. Our name soon will change to Combat Directorate, as it well should, since aviation is a tightly integrated component of the Combined Arms Team.

***MAST Saves Baby's Life***

SSG John A. McDaniel, 498th Medical Company, Fort Stewart, GA, removes mucus and drainage from an infant's mouth by gentle suction of a special syringe while en route via medical helicopter from Hazelhurst to Augusta, GA. The baby was suffering from severe respiratory problems

# U. S. ARMY
# Aviation Weapon Systems M

**COL W. Bruce Crowell, Chief** **LTC R**

Weapon Systems Management Office
AVSCOM

A MANAGEMENT concept widely used by industry has been adopted by the U.S. Army Aviation Systems Command (AVSCOM), a major subordinate command of the U.S. Army Materiel Command (AMC). Called Weapons Systems Management, the concept equates to program and configuration management—the total aircraft system integration. It provides a "focal point" for user and industry to consult on action related to a particular weapon system and all of its subsystems.

For many years, major Army weapon systems have been individually developed and supported by AMC commodity commands; for example, radios and electronics systems by the U.S. Army Electronics Command, missiles and missile systems by the U.S. Army Missile Command and aircraft and aviation equipment by AVSCOM.

The commander of AVSCOM, Major General Frank A. Hinrichs,* shortly after assuming his duties, recognized that the "systems approach" to the management of the multi-billion dollar Army aviation inventory appeared to be the most suitable technique to accomplish this mission. Extensive studies during 1973 and early 1974 determined the optimum systems management technique for the Army aviation community.

In these studies, numerous management alternatives were considered, compared and evaluated to determine their feasibility for use in the AVSCOM organization. Not surprisingly, it was found that the introduction of systems or program-type management into the weapon systems acquisition process repeatedly demonstrated that positive results can be obtained from an executive management type of organization.

As the result of these studies, the AVSCOM weapon systems management concept evolved. It is considered to be the most feasible method of improving AVSCOM support of aircraft weapon systems in the field. The concept draws upon the best of all the alternatives studied to achieve a total system orientation in the life cycle management of existing operational systems, as well as developmental systems envisioned for future use.

**What Do We Really Mean By Weapon Systems Management?** In implementing the concept, it was understood that Army aviation weapon systems management had worked effectively within the confines of AVSCOM since its creation. While there were good working relationships between functional directors such as the director of maintenance and the director of materiel management, etc., a definitive individual systems management focal point was required. This has been achieved through the establishment of a weapon systems management office (WSMO) and the appointment of a weapon systems manager (WSM) and small staff for each first line major aircraft system, as well as individual supporting and ancillary equipment systems which are AVSCOM's responsibility.

This small management group is given wide authority and responsibility to "oversee" the aircraft system from birth to obsolescence. Its ultimate goal is customer satisfaction through the attainment of high operational ready rates at minimal costs.

Essentially, this group is a management organization capable of performing overall program management for an assigned system throughout its life cycle. Major weapon systems currently are managed by a project or product manager during the system development phase. This type of management has proven effective for the intensive management required in that phase and the initial acquisition process. The weapon systems management concept continues this type of management into the operational phase. The manager has total program and budget control; he correlates requirements, integrates programs, allocates resources and reviews accomplishments to ensure completed program actions.

In reality, this position requires an individual to work with the functional managers and personnel. The key word is *with*—reflecting a team involvement with the various commodity elements which support the system management concept. This type of management creates

*General Hinrichs plans to retire at the end of this month. He is to be succeeded as AVSCOM commander by Major General Eivind H. Johansen

# Management

TC Richard F. Ropp, Deputy

a single point of contact on any weapon system within this headquarters. The systems manager has the authority and responsibility to take the necessary action to provide command integration toward resolving problems. Since he is familiar with all appropriate functional personnel, he can proceed to the heart of problems and arrive at sound decisions. He has immediate access to the commander on all problems which require his attention. For example, the WSMs for the UH-1 Huey and OV-1 Mohawk aircraft systems direct a small staff which includes personnel highly skilled within their chosen functional career field. These recently established management organizations have worked diligently to integrate internal AVSCOM operations and coordinate other agencies' involvement, thereby better serving the U.S. Army aviation user community.

**How Will This Style Of Management Directly Benefit Army Aviation?** This style of management provides the "focal point" at AVSCOM regarding a specific aircraft system. It draws together the best of the commodity management expertise; takes on a specific aircraft system orientation; and provides a dedicated program and configuration manager.

The weapon systems manager's single most important task is to be system-parochial – *his* system. He must be the total integrator of all subsystems pertaining to his aircraft system. He must orchestrate the various functional interests of maintenance, materiel management, procurement, production, research, development, quality and training, as they relate to the basic airframe and its subsystems (avionics, weapons, etc.), into programs which best compliment each other. The result is an efficiently managed and operating weapon system.

**How Does The Organization Operate?** Initial staffing and organization of the WSMO within AVSCOM were completed during the latter half of 1974. The office is currently staffed to provide necessary personnel for eight weapon system/equipment system divisions and a programs division which provides direct support to the systems divisions.

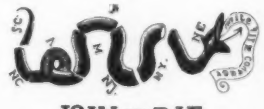
The commander has delegated his full-line authority and specific direction to each WSM through the means of charters. These charters are similar to those provided by the Department of the Army to project managers. In addition, a weapon systems management procedures manual has been developed within AVSCOM which supplements existing regulations and defines specific internal responsibilities and relationships concerning systems related plans, programs and budget controls.

All of the WSMs are grouped into one office, the WSMO, to assist the commander in reducing his span of control and to provide commonality of direction across functional lines. Each manager works closely with the chief of the WSMO and meets at least weekly with the commander to discuss his system.

Weapon systems managers operate in the matrix concept of management. They and members of their staffs operate horizontally across the existing vertically-aligned functional and action directorates. The WSMs accomplish this primarily through the use of a weapon systems management team. In addition to the system manager's staff, team members are designated by the appropriate functional directors to represent their interests in a specific weapon system. A typical weapon systems management team would include several representatives from each functional directorate, each proficient in his particular discipline. The teams meet as often as necessary, at least monthly, to discuss ways to capitalize on successes and to review and address all problems and programs relating to the particular system in question.

Externally, WSMs work closely with the aviation user community through the AVSCOM Field Services Activity (FSA), which is





assigned to the director for maintenance. AVSCOM field service personnel are assigned to the FSA and normally are collocated and closely interface with AMC Logistics Assistance Offices (LAO). In this way these managers ensure that the worldwide user community is provided expeditious and efficient operational readiness support.

**Colonel W. Bruce Crowell (L) is a Transportation Corps officer. He is fixed and rotary wing qualified and a Master Army Aviator. He has a BA in Economics and an MS in Public Administration**

**LTC Richard F. Ropp is also in the Transportation Corps. He is a Senior Army Aviator and is fixed and rotary wing qualified. He has a BA degree and an MS in Management**

The WSM concept does not change the usual day-to-day FSA and LAO activity operating within the functional disciplines. It does, however, offer the single system oriented manager at AVSCOM to whom the user can turn should existing channels of communications fall short of the desired results. The provision of this direct link, if required, ensures that management continuity exists where there may be a need for action among several AVSCOM functional activities.

Such a system fulfills one of the major goals of the concept—to provide a focal point to using organizations for expeditious problem resolution as well as authoritative program control and direction.

**Who Are The Current Weapon Systems Managers?** As indicated earlier, AVSCOM has given a charter to each WSM. They are delegated his full authority pursuant to their assigned mission and functions. Listed are the currently assigned managers, their assigned system(s)/ equipment, office symbols and AUTOVON telephone numbers.

Implementation of the AVSCOM weapon systems management concept adds the heretofore missing system focal point and systems orientation required for the life cycle support of Army aircraft systems.

The concept is not intended to replace existing functional activities, either in-house or in the field, but is intended to compliment those activities and to ensure that they are pulled together for the best interests of the Army. The commander, AVSCOM, considers the advent of systems management to be a significant step forward in responsiveness to the field and industry and in the efficient internal management support of major operational aviation weapon systems.

U.S. Army Aviation Systems Command
Weapon Systems Management Office

| Element | Managers | Office Symbol | AUTOVON |
|---|---|---|---|
| Wpn Sys Mgt Ofc Hqs | W. Bruce Crowell, COL Chief | AMSAV-SI | 698-5411 |
| | Richard F. Ropp, LTC Deputy Chief | AMSAV-SI | 698-3227 |
| Programs Div | Theodore Winder Chief | AMSAV-SIP | 698-5806 |
| Fixed Wing Div | Richard Tobiasen, LTC OV-1, U-21, RU-21 Wpn Sys Mgr | AMSAV-SIF | 698-3784 |
| Cargo Helicopters Div | Robert Reynolds, MAJ CH-54 Wpn Sys Mgr | AMSAV-SIC | 698-3869 |
| LOH Helicopters Div | Charles Callaway, LTC OH-58, OH-6 Wpn Sys Mgr | AMSAV-SIO | 698-2921 |
| Utility Helicopters Div | U.S. Large Jr., LTC UH-1 Wpn Sys Mgr | AMSAV-SIU | 698-3281 |
| RPV Div | Davies Powers, LTC Remotely Piloted Vehicles Wpn Sys Mgr | AMSAV-SIR | 698-5663 |
| Aerial Delivery Equipment Div | James Wood, MAJ | AMSAV-SID | 698-3241 |
| Ground Support Equipment Div | Richard Cseak, CPT GSE Wpn Sys Mgr | AMSAV-SIG | 698-3241 |
| Life Support Equipment Div | Mr. A. B. C. Davis LSE Wpn Sys Mgr | AMSAV-SIL | 698-3241 |

Listed below are project managed offices which have operational systems responsibilities with which the WSMO maintains interface and exchange of information.

**AVSCOM Project Management Offices**

| | | | |
|---|---|---|---|
| CH-47 PM Office (Fleet & Mod Program) | James Hesson, LTC (P) Project Manager | AMCPM-CH47M | 698-3984 |
| Cobra PM Office (AH-1G & TOW Conv Prog) | Charles Drenz, COL Project Manager | AMCPM-CO | 698-2331 |
| Acft Surv Equipment PM Office | Jack Keaton, COL Project Manager | AMCPM-ASE | 698-3961 |

*Continued from page 21*

In January 1975 the U.S. Army Logistics Center at Fort Lee, VA, tasked the Transportation School to develop a training program for selected aircraft maintenance MOSs similar to the original June 1974 proposal. The plan as developed is phased and structured with consideration for the limited in-house Reserve resources currently available, the absence of home station training resource, the limited training time and the timeframe available, and the programed active Army workload. It provides for a structured program flexible enough to be responsive to the unit's needs and assets yet rigid enough for programing training resources. The program further provides for training material along with sufficient guidance for meaningful home station inactive duty training (IDT).

The training concept involves a three-phase program. Phase I consists of 80 hours of active training (AT) conducted at the proponent school, a U.S. Army Reserve (USAR) school or as directed by the numbered armies in the Continental United States/ United States Army Reserve Command (CONUS/ ARCOM) commander. It encompasses a technical and general introduction into Army aircraft maintenance, test measuring and diagnostic equipment (TMDE), end item equipment to be maintained and similar topics. This phase may be attended by any individual either assigned or designated for assignment to a duty position requiring the skills of an aircraft repairman as appropriate to the particular program.

Phase II is designed to be accomplished at home station during a 10-month, 160-hour IDT period. It will be conducted with unit resources under the auspices and assistance of the U.S. Army Reserve School System. This part of the training program will concentrate on repair and maintenance of equipment with maximum emphasis on performance oriented training. Personnel entering this phase must be Phase I graduates except for those possessing adequate technical knowledge gained through prior experience. They may apply to the unit commander for a waiver predicated on successful completion of the Phase I evaluations.

Phase III will be conducted by the proponent school and consists of 80 hours of AT. This phase will consist of formalized training at the service school and be a continuation of Phase II with the necessary review, evaluation and award of MOS upon satisfactory completion of the evaluation. Those personnel entering this phase must have completed Phase II or have been school trained in an aircraft maintenance MOS that provided for basic helicopter or component maintenance training as appropriate to the MOS being pursued. Each MOS training package consists of a program of instruction, outline lesson plan for each unit of instruction, performance oriented evaluations, equipment requirements, study assignments, publication requirements, training film requirements and copies of school-produced software.

A 2-week formal supervisory training course also will be provided at the Transportation School for enlisted personnel at the four-skill level and above. This course also may be attended by aircraft maintenance officers and repair technicians. There are 13 courses (see figure 7) developed under this program and others will be prepared if required.

Figure 7

**Aircraft Maintenance Courses Developed**

**67N20 — UH-1 HELICOPTER REPAIR COURSE**
**67U20 — CH-47 HELICOPTER REPAIR COURSE**
**67V20 — OH-6 HELICOPTER REPAIR COURSE**
**67V2T — OH-58 HELICOPTER REPAIR COURSE**
**67W20 — HELICOPTER TECHNICAL INSPECTOR COURSE**
**67Y20 — AH-1G HELICOPTER TECHNICAL INSPECTOR**
**68B20 — TURBINE ENGINE REPAIRMAN (SINGLE-ENGINE)**
**68B30 — TURBINE ENGINE REPAIRMAN (MULTI-ENGINE)**
**68D20 — POWERTRAIN REPAIR COURSE**
**68E20 — PROPELLER AND ROTOR REPAIR COURSE**
**68F20 — AIRCRAFT ELECTRICIAN COURSE**
**68G20 — AIRFRAME REPAIR COURSE**
**AMSC — AIRCRAFT MAINTENANCE SUPERVISOR COURSE**

The Transportation School is dedicated to providing timely, accurate assistance to the Reserve components in support of the total force policy which is vital to the total logistic support of Army aviation. This aviation MOS training package is but a forerunner of programs that will be developed to assist the Reserves to be ready when called upon.

***Doctor Joseph A. Shields met little Ismara Praxeres on an overnight stop at her village about 100 miles east of Panama City, CZ, and learned of her medical history from the village elders. Ismara had been a healthy child until she was four years old. Gradually she lost the strength in her legs and stopped growing normally. Doctor Shields explained," . . . her paralysis may be reversible" and recommended to the village elders that the girl should be given treatments.***

***Doctor Shields made the arrangements for Ismara's treatments to be a free study case and asked the Army to provide transportation by helicopter. The 114th Aviation Company responded with a helicopter and crew.***

***After an hour of aerial searching along the tributaries of the Bayano River the village was located. Ismara was brought to the UH—1 by her mother and is now at Gorgas Hospital undergoing treatments for her condition.***

# Evolving Logistical Doctrine for the 101st Airborne Division (Air Assault)

Captain James A. Bell
Forward Support Coordination Officer
Headquarters and Headquarters Company, Division Support Command
101st Airborne Division (Air Assault), Ft. Campbell, KY

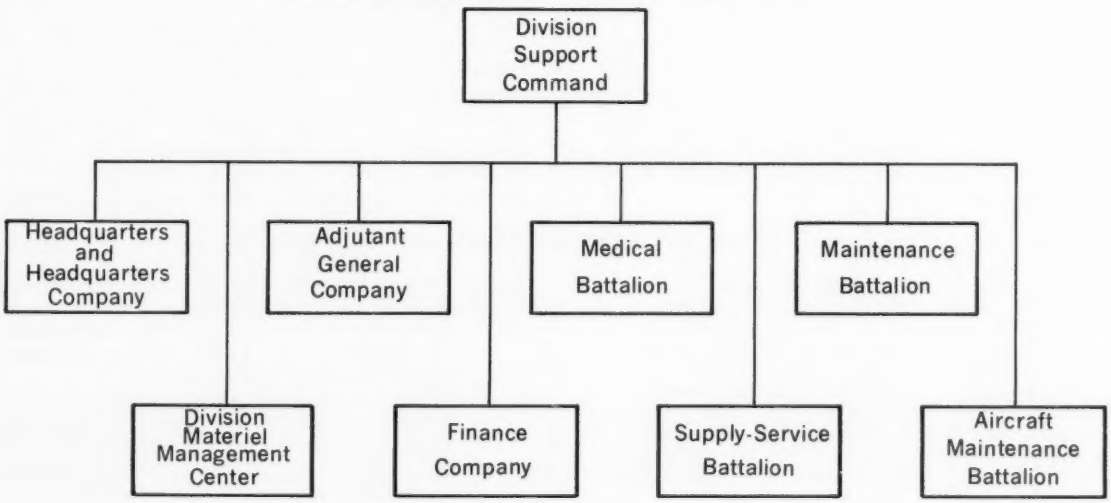
AIR ASSAULT logistical doctrine is continuously being revised through recurrent field training exercises and tests. The lessons learned are evaluated, and when appropriate, incorporated into standard procedures. The 101st Airborne Division (Air Assault) has unique, inherent mobility provided by its 422 helicopters. This allows the division to take advantage of and introduce many new tactical and logistical support concepts. Responsiveness and maneuverability are the key characteristics and capabilities of introducing these dynamic dimensions to the mid-intensity (high threat) battlefield.

The 101st Division is equipped, trained and committed based upon its air assault capabilities. This lightly equipped combat organization capitalizes on speed and flexibility and it can be deployed faster than any other division in the Army. Its light air assault characteristics also permit the division to operate from widely dispersed areas concentrating rapidly at the decisive time and place, then quickly dispersing to deny the enemy a lucrative target.

The division derives its maneuver capabilities from its organic helicopters. It also is limited, as is the helicopter, to extremes of weather; aircraft lift capabilities; communication distances; limited organic ground vehicular mobility and the enemy's air and air defense systems. To support the division and minimize inherent limitations, an extremely flexible support command was developed (figure 1).

Figure 1

Division Support Command (Air Assault)



The Division Support Command (DISCOM) provides combat service support to the division, including supply, maintenance, medical, adjutant general and finance. It also provides a rear area security/damage control center for the division rear area.

DISCOM is tailored to accomplish its mission by centralizing the coordination of all transportation assets and materiel management at the division support base, while providing Forward Area Support Coordination Offices (FASCO) in the forward area with the customer units. In addition to providing logistical planning guidance to the customer units, the FASCO provides the command and control, and communications to the division rear for the Forward Supply and Service Elements (FSSE).

The FSSE is designed to the size and mission of the combat and combat support units which are operating in the forward support area. The FSSE normally is manned and comprised of the type units shown in figure 2.

With the FASCO/FSSE located in the forward area, and main supply and service elements in the division rear area, the DISCOM control elements play a major role in processing, managing and planning logistical support in an air assault environment. This is accomplished through the use of the Division Materiel Management Center (DMMC) and the Division Movement Control Center (DMCC).

The DMMC has communications with the FASCO in the forward areas, the main support and service companies in the division rear area, and the next higher echelon of support. The DMMC is collocated with DMCC so that requests for supplies can be easily married with transportation support.

With the centralized control of assets, DISCOM can keep its

Figure 2
FASCO/FSSE Manning

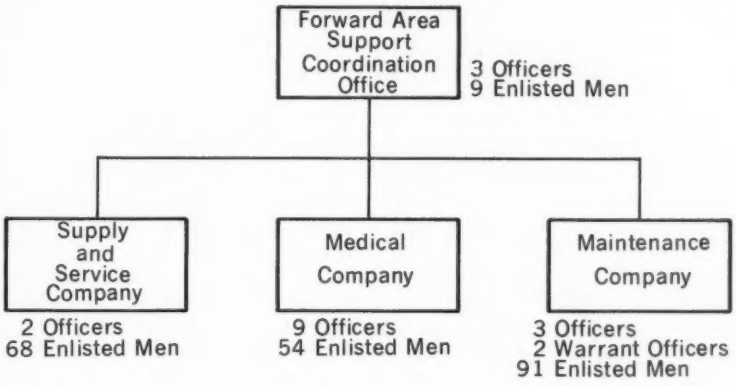
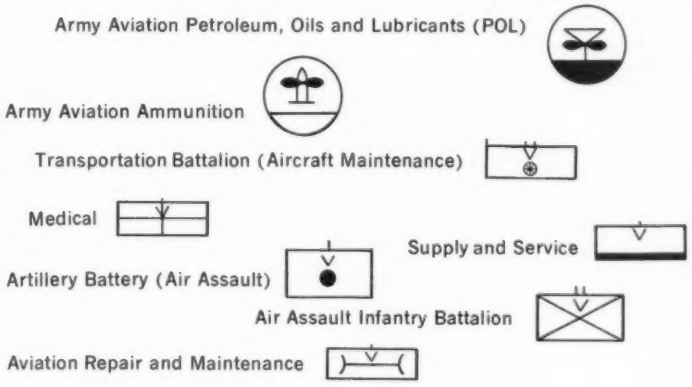



Figure 3
Key To Symbols, Acronyms and Supply Classes

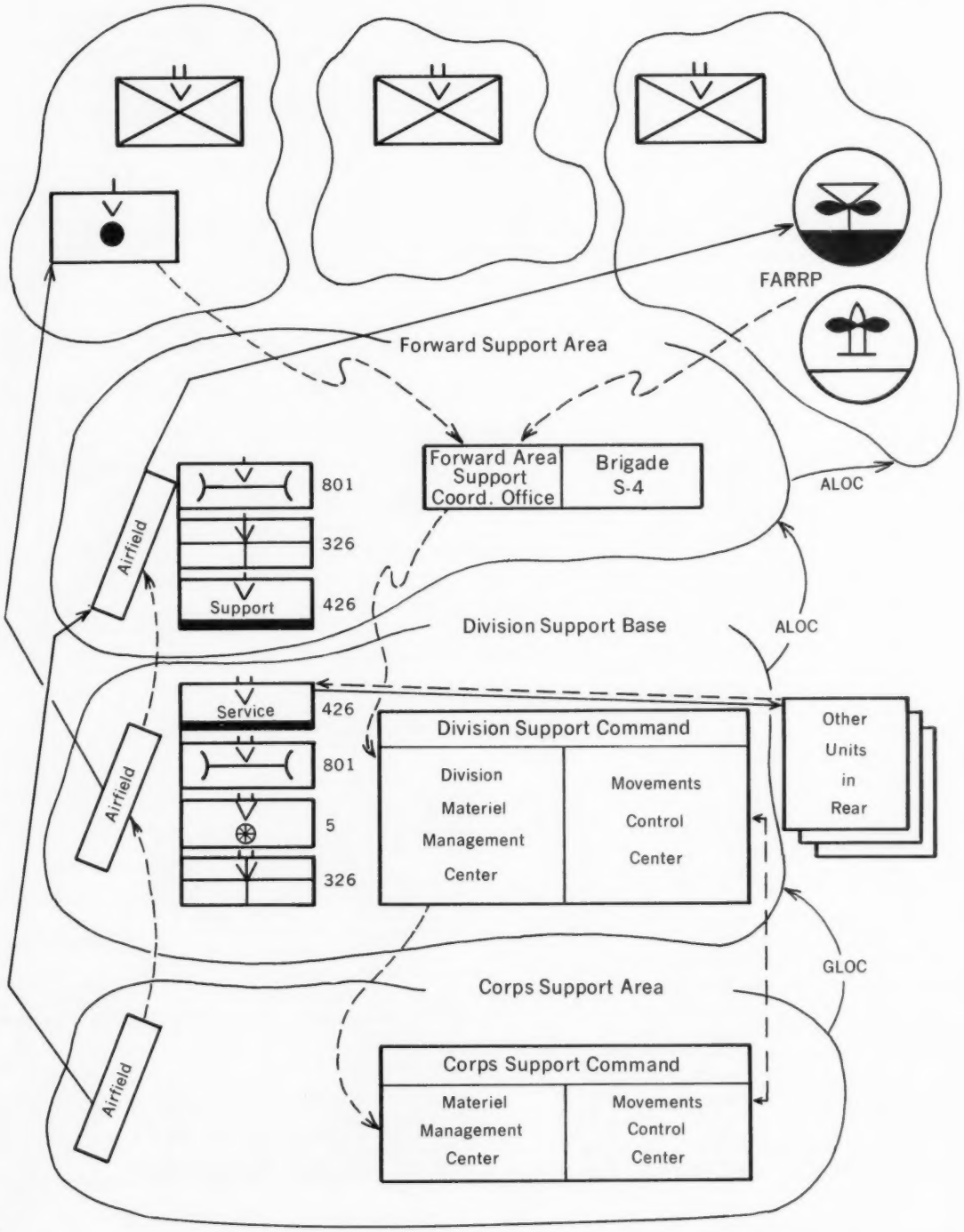



| | |
|---|---|
| ALOC | Air Line Of Communication |
| COSCOM | Corps Support Command |
| DISCOM | Division Support Command |
| DMCC | Division Movement Control Center |
| DMMC | Division Materiel Movement Center |
| FARRP | Forward Area Refueling and Rearming Point |
| FASCO | Forward Area Support Coordination Office |
| Through-put | Move Product/Supplies Direct To Using Organization |
| FSSE | Forward Supply and Service Elements |
| GLOC | Ground Line Of Communication |

| Class | Designation |
|---|---|
| I | Subsistence |
| II | Clothing, Equipment, Tools/Kits, Administative, Housekeeping Supplies |
| III | POL |
| IV | Construction |
| V | Ammunition |
| VI | Personal Demand Items |
| VII | Major End Items |
| VIII | Medical Materiel and Medical Repair Parts |
| IX | Repair Parts (less medical) |
| X | Materiel To Support Non-Military Programs |

See Key on page 29

Figure 4
Logistics Flow



hand on the pulse of the division's logistical posture and still maintain the flexibility necessary to keep up with fast moving air assault operations.

The concept of support that DISCOM provides is tied directly to the characteristics and limitations of the air assault division. Because of the customer unit's ability to pick up and move over large areas on very short notice, DISCOM has had to structure itself to be both mobile with its organization and also flexible with its system. DISCOM has accomplished this by maintaining one-day stockages of supply Class I, III and V (see figure 3) in the forward area with the minimum number of personnel and equipment necessary to support the mission. In addition, in the supply of Class III and V, DISCOM uses through-put (moves product direct to user) as much as possible from division rear or Corps Support Command direct to the user. This allows for quick redeployment of the forward support elements and lessens the vulnerability of the support elements in the forward area.

The flexibility of the system is dependent on how well the FASCO, in the forward area, keeps all concerned updated on requirements, unit locations and anticipated plans of the units in his area. Immediate communication at all echelons is the key to maintaining the flexibility of the support. Figure 4 shows how this communication and coordination is accomplished. The request is normally filled at the first echelon in the logistical flow that has the assets available.

The limitations of the system parallel the limitations of the division. The lack of ground vehicular mobility when air lines of communication (ALOC) are all that is available is a particularly tough problem for the division's support elements. Being totally dependent on helicopters in the forward area, customer units need additional Army aviation or U.S. Air Force assets to provide air drops and to maintain the required resupply tonnage. As an example, in a corps covering force operation, resupply to the forward areas requires on the daily average 120,000 gallons of JP-4 petroleum and 1,250 short tons of ammunition. This represents 239 CH-47 Super "C" sorties into the forward area daily if ground lines of support are not available.

Extremes of weather, sensitivity of the CH-47 Chinook helicopter to sophisticated enemy tactical air and air defense systems, and the lack of ground vehicular mobility upon completion of the delivery in the forward area provide some insight into the variety of problems the air assault division DISCOM has to deal with to provide support to the combat elements.

The 239 resupply sorties referenced above do not include the CH-47 sorties required for artillery displacement, movement of other classes of supply nor tactical troop movements. Planning and stringent control of CH-47 assets are critical in order to meet the demand.

Additional CH-47 sorties and ground transportation support from corps assets are essential, especially when the division is committed for extended periods and air lines of communication are used forward of the Division Support Base.

All of these factors must be considered by the Security, Plans and Operations Section (SP&O) of DISCOM in planning the logistical support concept of an operation. Once the commander has approved the support concept, coordination is made with DMMC, DMCC and Corps Support Command to define the management parameters. This is necessary to ensure that the assets available are properly used and that the support concept is executed in an efficient and timely manner.

This article provides an overview of the problems and current solutions being dealt with by logisticians and aviators of the 101st Airborne Division (Air Assault). Their successes and failures are developing a logistical system that can support air assault tactics and still survive in a mid-intensity environment. This evolving logistical doctrine will play a large part in determining the role the air assault division will have in the U.S. Army of the future.

### *For All Aviators New FMs*

***The basic manual for terrain flight training since 1973 has been TC 1-15, "Nap-Of-The-Earth Flight Training." Its up-to-date replacement is FM 1-1, "Terrain Flying" which provides "how to" information for the aviator. Guidelines are given to establish a flexible training program which is adaptable to any size unit. FM 1-1 will be new in style and format: a profusely illustrated, easy to read, multicolor manual without the old "1-7a (l) (a)" paragraph numbers! FM 1-1 will be available by October 1975. Try it, you'll like it.***

***Did you realize that there is a pocket-size publication in existence entitled "Aviators Handbook," FM 1-105? This pocket guide is designed so that you may have at your disposal, both in flight and during preflight planning, a handy summary of procedures and checklists which will facilitate mission accomplishment under any environment or threat. It answers many aviation-related questions that you always wanted to know but were afraid to ask. Your unit training officer can obtain this publication through pinpoint distribution.***

# T53 compressor stall

**Clarence J. Carter**
*Directorate for Aircraft Accident Analysis and Investigation*
*U.S. Army Agency for Aviation Safety*
USAAAVS

A RECENT CHECK of mishap files at the U.S. Army Agency for Aviation Safety (USAAAVS) shows an increase in the number of compressor surges and stalls involving T53-L-13 engines. And the most common cause is compressor erosion—a potentially hazardous condition.

Engines with eroded compressors generally do not exhibit any unusual symptoms and may perform normally, especially during cold weather operations. However, as the temperature increases, the requirement for engine power also increases. But, because the air is less dense, engine efficiency decreases, and the compressor must rotate faster to maintain proper compression at any given power setting. If compressor blades are excessively eroded, problems are almost certain to arise. The reason is simple.

A compressor is composed of a series of "little wings" (blades) each of which function aerodynamically in a manner similar to that of an aircraft wing. Erosion of these blades changes their shape and reduces their surface area. While loss of a few hundredths of an inch from a wing's surface will have a negligible effect on its performance or overall shape, that amount of change of a compressor blade will significantly alter both its size and shape, adversely affecting its ability to function. So much so, it will no longer be capable of supporting the "load" it was originally designed to carry, and the

Sand ingestion caused erosion. Note how wear becomes more pronounced in aft compressor stages where air velocity is greater and blades are smaller

inevitable result will be a compressor stall.

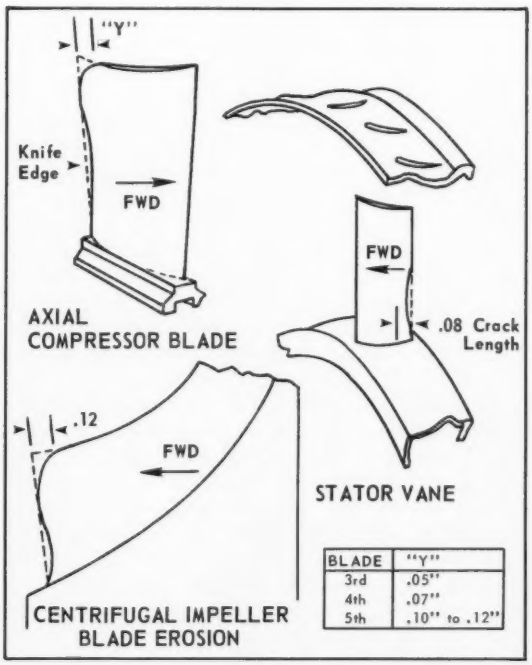
Since compressor blades operate at extremely high velocities, they are readily subjected to erosion when sand, grit or even small dust particles flow across them. Consequently, to protect these blades, we rely on air filters and particle separators. The filter strains the inlet air to remove a portion of the solid particles before it reaches the particle separator where additional solid matter is trapped. However, the separator is only about 70 percent efficient—and this is true only when it is properly maintained and kept clean. As dirt is allowed to accumulate, its efficiency is markedly reduced. One point we need to keep in mind is that the separator is *not* designed to trap *all the large particles* and approximately *70 percent of the smaller ones,* but rather to retain 70 percent of *all* solid matter that enters it. This means that under ideal conditions, we can expect about 30 percent of all particles—both large and small—that get into the separator to pass through the engine. For maximum protection from erosion, the filters, particle separator and engine must all be kept clean. This holds especially true when the engine is being operated under extremely dusty conditions. And what constitutes extremely dusty conditions? Any time dust generated during hover is sufficient to obstruct the pilot's vision, or if he is forced to "fly" his approach to the ground for reasons of visibility—that's "extreme" enough.

Greatest compressor erosion occurs first in the aft compressor stages where air velocity and pressure are greatest. Unfortunately, this is also the area where the smallest and thinnest blades are located. When they become worn and lose their efficiency, a deceleration (decel) stall is likely to occur when power is reduced. During power reduction, the bleed band opens, causing a sudden increase in airflow velocity. This combination of increased airflow and the changed configuration of the blades due to wear results in a compressor stall.

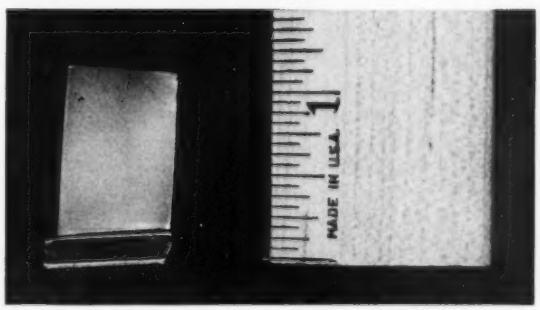
As opposed to the "decel" stall, another type can occur when increased power is demanded. Consider the following hypothetical example: Suppose the compressor in your engine is eroded to a point that it is marginal, but shows no noticeable degradation of power at 37 to 38 psi $N_2$ torque when the OAT is 50 degrees F. Now suppose you fly to a pickup site where your aircraft is loaded with cargo until it is near its maximum permissible gross weight. By the time you are ready to depart, the OAT has risen to 70 degrees F., and lift-off may require 42 to 44 psi $N_2$ torque. Then, with instruments showing normal indications, you increase power to 45 to 47 psi for climbout. Suddenly you hear a "bang" and out of the sky you drop—right over the trees. Why? The compressor was just too sick to "hack" it.

While the "decel" stall serves as a positive indicator that all is not well within the engine, it seldom causes damage. On the other hand, the type of stall that can occur when power is demanded poses a serious threat to the safety of both aircraft and occupants, and must be avoided. Not only can it force the aircraft down over an area unsuitable for a successful landing but, worse yet, it can cause mast bumping, structural failure and a catastrophic accident.

**What we can do.** To begin with, we can ensure filters, particle separators and engines are properly




Drawing supplied by AVSCOM shows components to be checked and guidelines to be used. If wear is equal to that shown, the engine should be removed for depot maintenance




Because of its small size and high speed operation, blade configuration can be readily altered by erosion. Blade is from 5th compressor stage

inspected, maintained and kept clean. Next, we can frequently inspect that portion of the engine that is visible for any warning signs that might indicate an eroded compressor. This includes a check of the inlet guide vanes for a sandblasted or polished appearance, and the first stage compressor blades for any detectable erosion in the blade root areas.

We can then ensure a HIT check is performed daily, before the first flight, and before every flight when the aircraft is operated under extremely dusty conditions. Should the egt increase 20 degrees or more during the check, we should follow normal troubleshooting procedures. The following serves as a guide:

- Ensure the filters, particle separator and engine are clean.
- Check all bleed air sources for leaks and proper operation.
- Check the bleed band and bleed band actuator for proper operation, security, cleanliness and proper rigging.

NOTE: One Army installation has recently experienced an abnormal number of "decel" type compressor stalls. Inspections revealed the cause to be binding of the bleed band actuator piston due to contaminants entering the actuator cylinder during engine cleaning operations, causing erratic operation of the actuator. All engines were cleaned in accordance with paragraph 7-15, page 7-3, change 9, TM 55-2840-229-24. Paragraph 7-15a(7) of above reference states that *if* a source of metered compressed air is available, the engine bleed band *can* be closed to permit more thorough cleaning of the centrifugal compressor stage and to preclude cleaning solution from spraying out the air bleed ports. Although the TM does not require this step, cleaning solution along with dirt and engine deposits will spray out the bleed ports when it is omitted. Some of this mixture can then enter the exposed actuator, causing erratic bleed band operation and compressor stall. When a source of compressed air is not available, the Army Aviation Systems Command (AVSCOM) recommends the actuator be wrapped securely with a plastic bag held in place with tape to prevent discharge of spray on upper portion of actuator from where it can enter into the cylinder.

The Powerplants Branch of AVSCOM is currently analyzing the problem and will disseminate instructions for cleaning and inspecting the bleed band actuator in the near future.

- Check the variable inlet guide vanes (VIGV) for proper operation, condition and rigging.
- Inspect the fuel control unit for leaks, condition, operation and rigging. NOTE: Correct rigging of the fuel control unit is vital. USAAAVS files show numerous instances of fuel control units having been needlessly replaced following compressor stalls. When these units arrived at the overhaul depot, they were found to function properly. Had they been rerigged before removal, they would have operated properly and would not have been replaced.

If no discrepancies are found during the five troubleshooting steps, the upper compressor half should be removed and the blades inspected in accordance with paragraph 12-39, page 12-11, change 4, TM 55-2840-229-24/T.O. 2J-T53-163. This inspection is mandatory anytime the engine is suspected of having encountered a compressor stall.

**You can help.** How many hours can an overhauled engine be expected to operate under normal conditions before erosion will have advanced to a point that a compressor stall can occur? After how many hours of operation under extremely dusty conditions? Are engines of a particular serial number series more apt to give problems than those of another? Could parts have been manufactured or overhauled to wrong specifications? If so, are you operating engines that have any of those parts installed? If you are, wouldn't you like to know it as well as on which engines those parts are installed?

USAAAVS would like to provide you with this information. Unfortunately, it is not available; and it is not available because all requested information is often omitted from crash facts messages.

USAAAVS receives as many as 20 crash facts messages a day concerning engine problems alone. When these messages do not contain the engine serial number, number of overhauls, hours since overhaul, hours since new, hours since last installation, and the last overhaul facility, USAAAVS cannot determine trends, pinpoint problem sources, nor predict failures. So, in the future, help us help you by taking the little extra time required to ensure your crash facts message includes all requested data. This is required in accordance with paragraph 4-2, AR 385-40 and chapter 14, AR 95-5.

Meanwhile, the Powerplants Branch of AVSCOM is developing an erosion indicator that will provide pilots and maintenance personnel with a visual means of detecting compressor erosion and determining the extent of this erosion. But because this project, which USAAAVS is closely monitoring, is still in the planning stage and funds are still pending, it may be two or three years before it is completed. Meanwhile, the best deterrent to sick engines is a healthy professional approach to the problem by following good engine maintenance and inspection practices and performing thorough troubleshooting procedures—BY-THE-BOOK.

# NIGHT VISION

**Adapted from a Navy pamphlet, NAVAER 00-80T-77**

MAN HAS LEARNED to adapt himself well in all types of environments. He has learned how to keep warm in the arctic and cool in the desert. His inventive mind has enabled him to breathe under water and in outer space. Man is continuing to meet the challenges of his environment and is still learning to adapt.

When darkness hampers man's activities, he depends on artificial light. But in aviation, man is having to meet another challenge. He has found it necessary to fly during the hours of darkness but is now hampered by artificial light. The lights used to detect his enemy also enable his enemy to detect him. So now, aviators must learn to see in the dark with their own two night eyes.

Good eyes are essential in aviation but having good eyes and seeing well are not necessarily synonymous, just as owning a fine car doesn't make you a skillful driver.

You will never see as well at night as an owl or a tomcat but with training you can learn to see a lot more at night than you ever thought possible. Aside from the obvious fact that you can't see as much in darkness as in daylight, there are three reasons it takes thought and training and practice to get the most out of your night eyes.

1. Your mind and your eyes are a team. To see well, you must concentrate on seeing and put effort into it. If you don't, you don't see.

2. Your eyes are so built that you have to learn to use them in a different way at night.

3. Your eyes tell you so little and familiar things look so different at night that it takes practice to recognize the things your eyes see.

**Mind and eyes are a team.** That's the first thing to remember. If your eyes are on one thing and your mind is on another, you don't notice what your eyes see. Only when both your mind and your eyes are on *seeing,* only when they team up, do you see well. This teamwork is absolutely essential. The signal being sent by the eyes is somewhat weak to start with so if your mind is working on a plan for getting you close to the little blue-eyed blond cashier in the PX, then the signal won't get through. But if suddenly a flare lights up the sky and catches your attention, you will forget about the blond. Even then, with your attention on seeing, only a few things can enter the *mind's eye* at one time. What does this add up to? It means that you must know what you are looking for and you must keep your *attention* on seeing.

**Night eyes.** The light-sensitive nerve ending at the

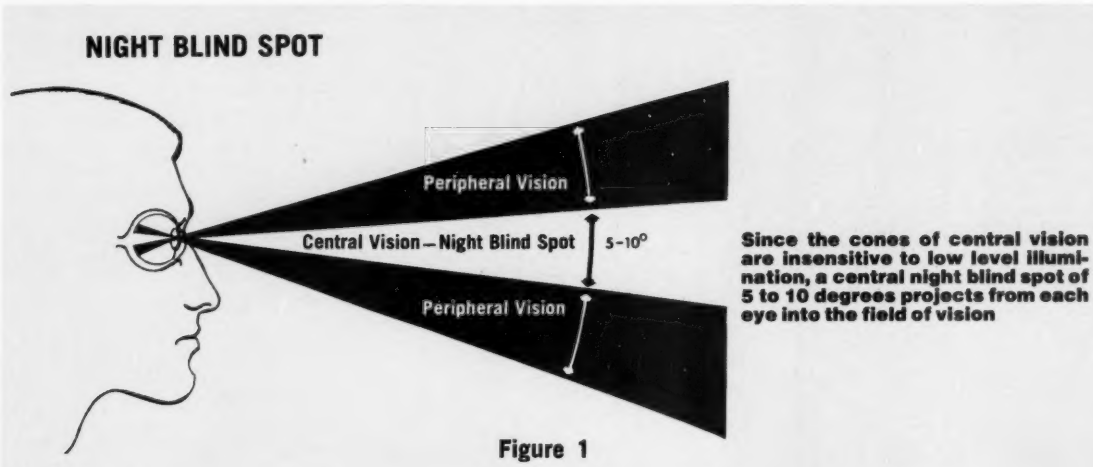

NIGHT BLIND SPOT
Peripheral Vision
Central Vision—Night Blind Spot
5-10°
Peripheral Vision
Since the cones of central vision are insensitive to low level illumination, a central night blind spot of 5 to 10 degrees projects from each eye into the field of vision

**Figure 1**

back of your eyes are of two kinds—cones and rods. The cones, millions of them, are concentrated in the center or bulls-eye area. The rods, more millions of them, are concentrated in a ring or circle around the cones.

Broadly speaking, you see with the cones in daylight and with the rods at night. There is no sudden boundary. In daylight you depend on the cones to do most of your seeing. In full moonlight, the cones and rods divide the work. In starlight, the cones quit work and the rods alone do all the seeing. As the cones lose their efficiency in dim light, the rods take over. They can detect light at 1/5000 of the intensity at which the cones go blind.

**Night blind is quite blind.** As everyone knows, when you go from a brightly lighted room into the dark you can't see anything at all until your eyes adjust to the dim light. First the pupils of your eyes open up to let in all the light there is. Then the cones begin to adjust to darkness. After 6 or 7 minutes your eyes have become 100 times more sensitive and you can see a little bit. The night seeing rods adjust much more slowly but, when they have become adapted, are 100,000 times more sensitive than they are in sunlight, and you can see a lot if you know how. This takes time—at least 30 minutes for the rods to adjust to the darkness.

On the other hand, when you go from darkness to bright light your eyes adapt after only a minute or two of dazzle. They adjust so fast that 10 seconds of bright light destroys much of your ability to see in the dark and you have to start all over again to get your night eyes back.

Since you can't see in the dark unless your eyes are adapted, since it takes 30 minutes to adapt your eyes and only seconds to lose the adaptation, the first principle of night seeing is: *Adapt your eyes and keep them adapted.*

**Adaptation.** The obvious way to adapt your eyes is to sit in the dark for 30 minutes before every night flight. The obvious way is also dull.

Science has discovered, however, that while you can see with the cones in red light, the rods react to red light much as they do to darkness. This means that if you stay in a red-lighted room or wear red adaptation goggles in ordinary light, the rods will adapt while you use the cones to read or play cards. After a half hour in this synthetic night, your eyes will be ready for the real thing.

After your eyes are adapted, continue to avoid all but red light. Even the flare of a match or a brief flash from a flashlight will seriously interfere with your dark adaptation.

Use as little light as possible in your aircraft. Practice blindfold drills. Pilots should train themselves to do all manual operations without light.

You can't read instruments or charts without light, but you can use as little as possible. Always study your charts thoroughly before a flight so that you won't have to pore over them in the air. Staring at instruments tires the eyes and may reduce seeing efficiency as much as 50 percent. Whether you are flying with white-lighted or red-lighted instruments, look at them as briefly as possible and keep all lights turned low.

If there are times when you must use white light in a pinch, preserve the adaptation in one eye by shutting it. When you open it again in darkness you will be able to see with it while the other eye is readapting.

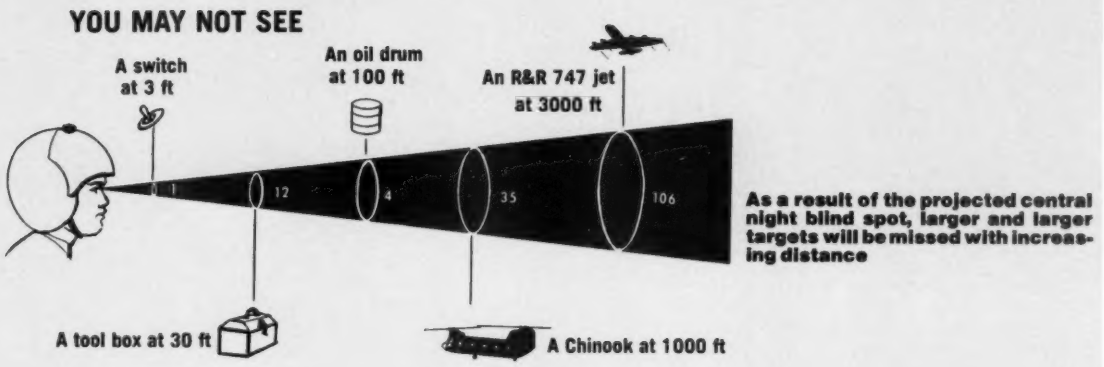

YOU MAY NOT SEE
A switch at 3 ft
An oil drum at 100 ft
An R&R 747 jet at 3000 ft
1
12
4
35
106
As a result of the projected central night blind spot, larger and larger targets will be missed with increasing distance
A tool box at 30 ft
A Chinook at 1000 ft

**Figure 2**

After you have adapted your eyes and learned to keep them adapted, your night seeing problems have just begun.

When something catches your attention out of the corner of your eye, ordinarily you turn your eyes toward the object to get a better look. This is the right way to look in daylight, when the point of sharpest vision is at the center of the eye. It's all wrong at night. When you look directly at an object you are trying to see through your night blind spot in the center of your eyes. Night vision is impossible at the center of the eye. To take advantage of the rods at night, always look slightly *away* from the object you want to see!

When you catch an object out of the corner of your eyes, try to hold your eyes just a bit off center and you will have the object at the point of maximum sensitivity. If your eyes move irresistibly toward the object, let them swing through so that you can pick it up again at the other side of your eyes.

If you see an aircraft and then lose it, don't try to bore through the darkness to find it again. Instead of staring at the spot where you lost it, move your eyes around the spot in a circle, focusing always slightly away from that point. If it's there you will pick it up again by looking to one side of it or over or under it. It takes practice but it works.

Learn to move your eyes frequently in dim light. The rods tire quickly and are at their best only for short periods. As you search, don't sweep the sky at random; *scan* by searching a small area carefully, then jumping your eyes to the next area. You can't see anything while your eyes are in motion, but they are sensitive just after moving. Move them in short jumps so that you see all parts of the search area in succession. Do it slower than you would in daylight. If an image becomes blurred or starts to fade, it's because the rods are going into a slump. Night nerves tire easily but blinking or moving the eyes around tends to resensitize or rejuvenate them.

Since this kind of seeing is not, by any stretch of the imagination, second nature, you will have to practice it until it becomes automatic. Remember that every bit of training and practice you give to night seeing will repay you in better seeing.

In daylight you see the color and detail of an object, as well as its size and the contrast it makes against its background. From a lifetime of experience and practice, you interpret what your eyes pick out and thus identify the things you see. You use your night eyes in the same way, *except that your night eyes see no color and little detail.* Therefore, you depend entirely on the size of an object and the contrast between the object and its background to see it. This means that familiar things look quite different from the way they look in daylight. Details fade away and backgrounds blend with the object you are trying to see and outlines become less distinct at night. Since you have not had as much practice in night seeing as in day seeing, they are also harder to identify.

Your eyes furnish you with so little information at night that you must be able to interpret the smallest clues in order to see the objects your eyes pick out.

The eyes of a pilot experienced in day flying may be no better than the eyes of a passenger on his first hop, yet the pilot *sees* more because he knows what to look for and how to interpret what his eyes tell him. In the same way, the man with night flying experience can see more than men with no night ex-

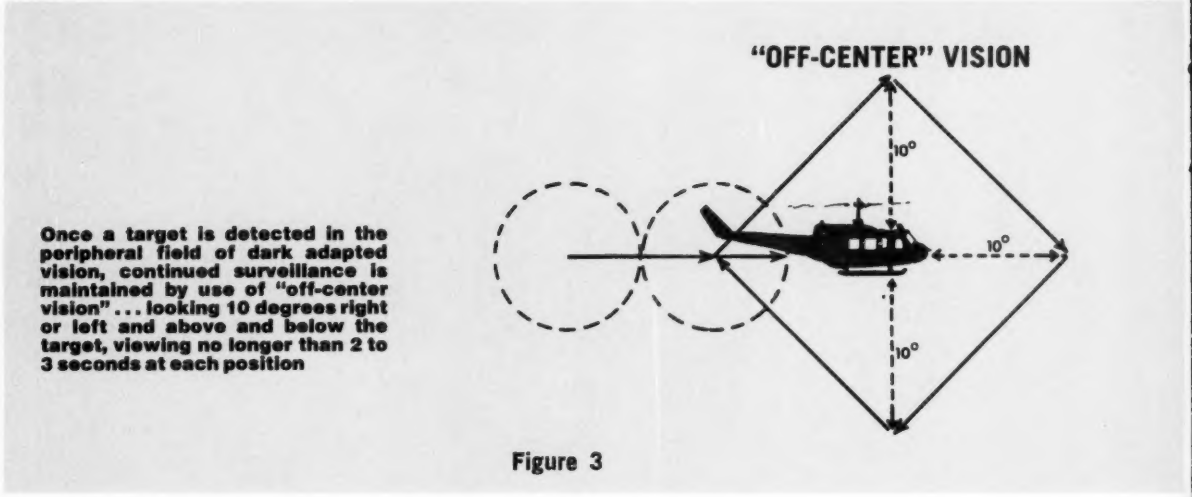

"OFF-CENTER" VISION
10°
10°
10°
Once a target is detected in the peripheral field of dark adapted vision, continued surveillance is maintained by use of "off-center vision"... looking 10 degrees right or left and above and below the target, viewing no longer than 2 to 3 seconds at each position

**Figure 3**

perience. He not only knows *how* to look, he knows what planes in the air and objects on the ground look like from the air at night.

Night conditions are so varied it is impossible to go into detail on night recognition. The main thing is for you to use every night flight to learn more about night seeing.

It is hard to estimate distances at night. Nevertheless, if you search methodically, you can develop a scanning routine for night visual searches. The idea is to avoid the extremes of blank staring or sweeping the sky. Divide the lookout sectors with your crewmembers so that, with each man responsible for scanning a limited field, all visible areas are covered.

The average aircraft is not large enough to be seen much beyond 600 feet in clear starlight. It is visible within that limit only if you are above or below it so that you have a chance to see it in plan view. From ahead or astern it presents too small an area. That's why you must be able to identify the plan view of any aircraft you are likely to encounter.

**Vertigo.** A common experience in night flying is vertigo, dizziness, spatial disorientation, or whatever you want to call it. It is usually worse just after a takeoff from a lighted runway than any other time. The sharp change from dazzle to utter darkness brings on an eerie feeling of everything going cockeyed. To aid in overcoming vertigo you must learn to trust your instruments completely. Failure to trust the instruments will only lead you astray and exaggerate the feeling of uncertainty growing out of conflicting sensations.

**Moving and stationary lights.** There are a number of other things you must guard against in night flying. Often, when you are in formation, you can't see anything of the aircraft ahead of you except its taillight. It is hard to judge distance from a single point of light in a night sky. The brightness of the light is the only clue to its distance, and atmospheric conditions can alter that brightness. It is also sometimes difficult to distinguish aircraft lights from fixed lights, either stars or ground lights.

Even more important, it is known that if you stare too long at a single fixed point of light against a dark background, it may appear to wander. This apparent wandering of a stationary light is known as *autokinetic movement.* It will help greatly if you keep your eyes moving. Fix on a light long enough to place it, but don't stare. If you can see stars or landmarks, shift your focus from time to time. When you can see neither stars nor landmarks, shift your eyes from the taillight ahead to your instruments or some cockpit feature and back again. These eye movements will help to keep your eyes sharp and to maintain your orientation.

**Clear view.** It is even more important at night than in daylight to keep your windshield and windows clean and unscratched. Tests prove that a thin film of oil or dirt on a windshield will reduce visibility by more than 50 percent. Haze, fog, dirt, scratches—anything which absorbs or scatters light—reduce contrasts and make seeing harder. You can't do much about haze or fog, but you can keep the plexiglass spotlessly clean. Make sure that there is no glare or reflection from the instrument panel in your windshield.

**Oxygen.** At night, vision is the first thing affected by a lack of oxygen. If your job in the air calls for sharpness of night vision and if oxygen is available, use it from 5,000 feet up.

**To scan effectively, look systematically from right to left and top to bottom at the field to be viewed, using 10 degree overlapping glances of 2 to 3 seconds each. Though it is the central visual axis that determines the scan, it is peripheral vision that detects and acquires anticipated targets**

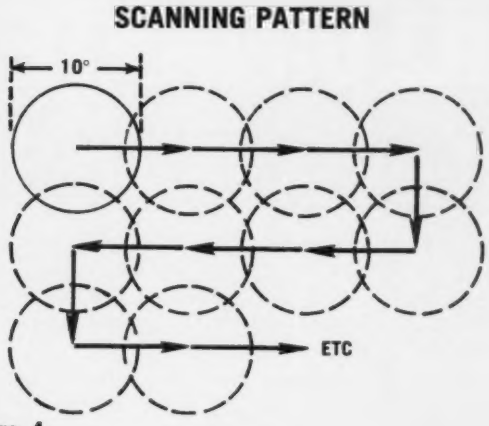



**Figure 4**

Your night seeing margin is so small that the slightest lack of oxygen affects your seeing. At altitudes over 5,000 feet, instrument markings seem dimmer. You begin to turn up the panel lights in order to see better. The more you turn up the lights, the less you can see outside. You impair your night adaptation, just as lack of oxygen is making your eyes less efficient.

At 12,000 feet, without oxygen, you can't see nearly as well as on the ground. At 16,000 feet, your sight is seriously impaired. Even though you don't realize how much it is affected, you can't see as far and your vision becomes fuzzy around the edges.

If you wait until you reach 16,000 feet before using oxygen, it will take several minutes before your eyes reach full efficiency again. If you need your night eyes, don't wait; use oxygen from 5,000 feet up.

**Vitamins.** If you are a victim of a vitamin shortage it will impair your night vision. All publicity to the contrary, however, neither extra doses of vitamins nor a carload of carrots will improve your seeing if you are eating a normal amount of the right foods—fresh fruits, vegetables, butter, milk, cheese, eggs, liver, and fish. If you are where fresh foods are short, or, if you think you aren't getting enough vitamins, ask your flight surgeon for vitamin pills.

**Smoking and drinking.** Heavy smoking may significantly reduce your seeing ability especially at night. Oxygen ($O_2$) is carried to all parts of the body by the hemoglobin (Hgb) in the blood. Smoking or being in a confined area where a nicotine fiend is smoking can cause carbon monoxide (CO) to enter the blood. Unfortunately the Hgb attracts and combines with the CO more quickly than with $O_2$. Therefore, the blood cannot carry enough $O_2$ and the brain and eyes are the most sensitive to any $O_2$ deficiency. So in essence, even though the small quantity of CO may not be fatal, it is still the culprit because it interferes with the delivery of $O_2$.

Heavy drinking can also reduce your seeing ability. Alcohol slows the absorption of oxygen through the tissues of the lungs. A hangover may double or triple the amount of light you need to see something.

**Drugs.** The vast majority of drugs are harmful in the seeing department. Stay away from them, except on the advice of your flight surgeon.

**Fatigue.** Fatigue impairs vision—particularly night vision. It also makes it harder to keep your mind on your job, slows coordination and results in poor judgment. If you are overtired you may get careless and satisfied with half-efficiency. If you do have to keep going when you are bushed, remember the dangers of fatigue. And when you can, get sleep.

For tired eyes, incidentally, the best remedy is also the obvious one—sleep. If there is anything wrong with your eyes that sleep won't cure, see your flight surgeon.

**Comfort.** Comfort, as much as is possible, is also a necessity for good seeing. If you are half-frozen, cramped, or if your gear is bothersome, you don't see as much because you can't concentrate as well. You aren't flying a Hollywood divan, so the extremes of comfort aren't always possible. But avoid the discomfort you can by taking proper care of your gear and using it as it is intended to be used.

Train yourself to see in the dark. There is more there to see than meets the untrained eye.

# ILLUMINATE WITH TAPE

Patsy Thompson
*Publications and Graphics Division*
*U.S. Army Agency for Aviation Safety*
USAAAVS

AIRCRAFT LANDING, operating and parking areas can become treacherous at night when ground support personnel and equipment, other ground vehicles and obstacles are not visibly marked. For example, a pilot was taxiing his aircraft to the parking area when one of the propellers struck a fire extinguisher, damaging aircraft and extinguisher. True, the extinguisher should not have been left in the area, but it was. Had the extinguisher been marked with a band of silver white highly reflective tape, this mishap may not have occurred.

Paragraph 8-69, chapter 8, section IV, TM 55-1500-204-25/1, lists minimum requirements for reflectorizing ground support equipment used on flight lines. It calls for 4-inch wide strips of silver white reflective tape, NSN 9390-00-174-2323, which conforms to Federal Specification L-S-300B, dated 12 July 1974, and which can be applied to surfaces at temperatures down to -10 degrees F. If the 4-inch tape is excessive, then the widest tape possible should be used. The tape should be applied along the extreme perimeter of the equipment to reflect its general outline configuration when operating under reduced lighting conditions. When possible, the tape should be applied to delineate the entire perimeter of the equipment. However, equipment having compound curves at the corner or large rivets, bolts, nuts, etc., need not be marked in these particular areas, providing the marker presents a general outline of the equipment. The tape should not obliterate other required markings, such as caution, danger, nameplates, and servicing or safety instructions.

Before applying the tape, free the surface of all loose scale and dirt with a wire brush or cleaning compound. Afterwards, thoroughly wash the surface with clear water and dry with high-pressure compressed air.

To prepare the tape for marking the equipment, first measure and cut to the desired lengths. Remove the paper liner from the adhesive by holding the reflective side in and flicking one corner sharply in toward the reflective face. When the corner is loosened, lay the reflective side down on a smooth surface and jerk the paper liner off to half the length of the strip and then fold the loosened paper liner. Next, position onto equipment by adhering one edge of the tape with finger, holding the unapplied portion slightly away from equipment surface to prevent premature adhesion. Wipe the tape to the surface with firm pressure, using a plastic squeegee. Remove remaining liner and apply, pricking any air

**TABLE 1**
**Reflective Items**

| | | |
|---|---|---|
| **Reflective Tape and Sheeting** (Low temperature [-10° F.] pressure sensitive adhesive backing, Reflectivity No. 1) | | |
| NSN 9390-00-174-2322 | Silver White | 2 in. by 50 yd. |
| NSN 9390-00-174-2323 | Silver White | 4 in. by 50 yd. |
| NSN 9390-00-124-8445 | Silver White | 6 in. by 50 yd. |
| NSN 9390-00-040-6102 | Yellow | 2 in. by 50 yd. |
| NSN 9390-00-040-6114 | Yellow | 4 in. by 50 yd. |
| NSN 9390-00-040-6133 | Yellow | 6 in. by 50 yd. |
| NSN 9390-00-040-6104 | Red | 4 in. by 50 yd. |
| NSN 9390-00-040-6103 | Green | 4 in. by 50 yd. |
| **Reflective Fabric (Sew-on Type)** | | |
| NSN 9390-00-441-9516 | Silver White | 1 in. by 50 yd. |
| NSN 9390-00-481-3424 | Silver White | 2 in. by 50 yd. |

**Reflective Safety Items (Clothing)** (Authorized in accordance with CTA 50-900)

Vest, Safety: Reflective Orange Fabric, Vest, Safety RV-1, NSN 8415-00-177-4974

Band, Arm, Safety: Reflective Orange Fabric, Band, Arm RAB-1, NSN 8465-00-177-4977

Band, Leg, Safety: Reflective Orange Fabric, Band, Leg, RLB-1, NSN 8465-00-177-4975

Band, Sleevelet, Safety: Reflective Orange Fabric, Band, Sleevelet RS-1, NSN 8465-00-177-4976

Band, Helmet, Safety: Reflective Orange Fabric, Band, Helmet RHB-1, NSN 8415-00-177-4978

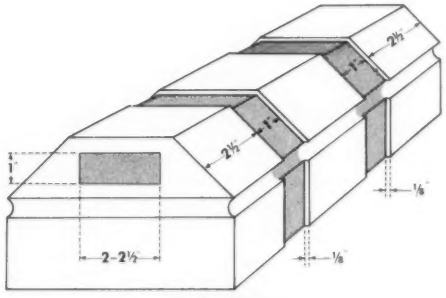



FIGURE 1

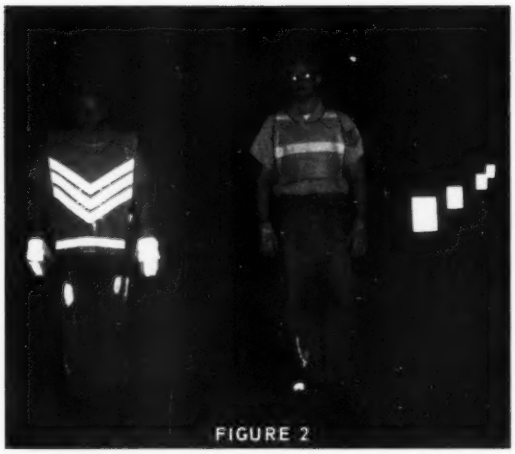


FIGURE 2

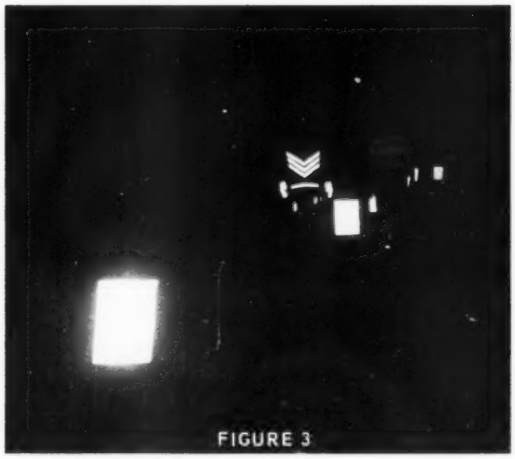


FIGURE 3

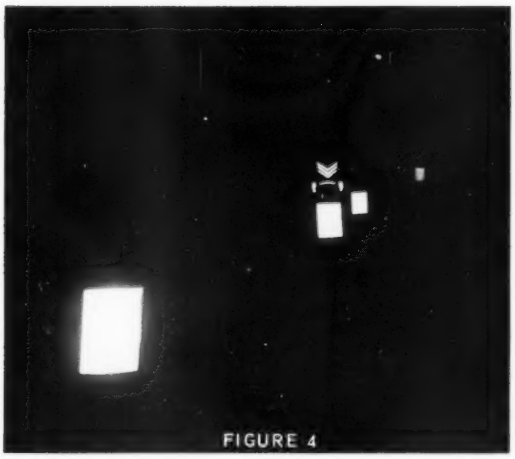


FIGURE 4

bubbles with a pinpoint and working air out with the squeegee. Then apply a clear varnish sealer, as recommended by the manufacturer, to the edges of the tape to prolong the life of the marking.

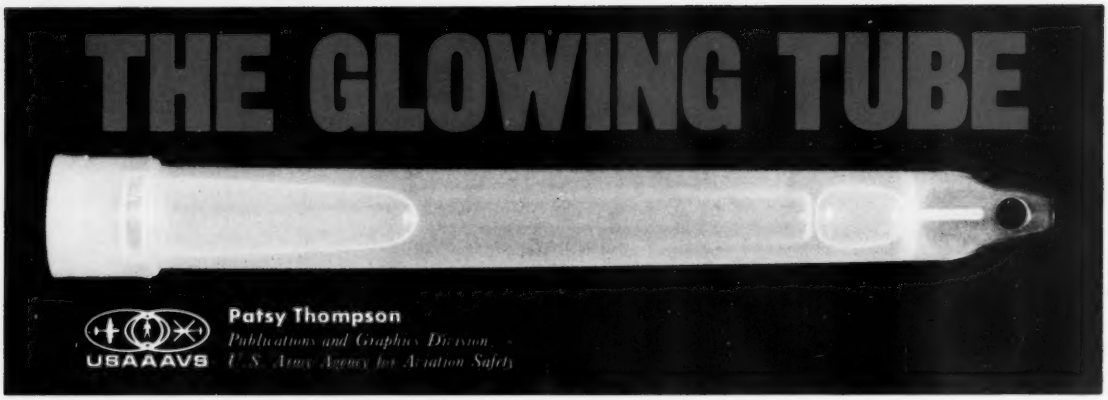
In addition to ground support equipment, it is also recommended that all ground vehicles (such as 3/4-ton trucks, jeeps, fire trucks, follow-me trucks), fireplugs, fire extinguishers, fences, corners of buildings, heliport gates, foreign object containers, and wheel chocks be marked with the silver white reflective tape or sheeting material.

Well used wheel chocks are inherently dangerous during ramp operations as they are practically invisible at night. One suggested method of improving the "see-ability" of chocks is to:

- Route two areas 1-inch wide by 1/8-inch deep around chock, centering the grooves 3 inches from each end as shown in figure 1.
- Remove dirt and chips from routing by blowing clean with compressed air and then wiping with tack rag or rag dampened with lacquer thinner.
- Brush a thin coat of clear liquid primer on the routed areas and let dry for 5 minutes.
- Insert a strip of conformable reflective tape or sheeting in the routed areas and a 1-inch by approximate 2-inch strip across each end above the rope groove. Using firm pressure on a plastic scraper, start at the center of the tape and wipe out to each edge of chock. If the routed areas are unusually rough, a balled-up rag can be used to work the tape into the indentions.

Unmarked ground support personnel working on flight lines at night present another risk, which can be reduced by marking work uniforms with a reflectorized fabric that can be sewn onto the clothing, by marking sound attenuators and helmets with reflective tape, and by using available reflective safety clothing items (table 1). For instance, look at figures 2, 3 and 4. The reflective rectangular panels are spaced 100 feet apart to denote the distance at which they can be seen. Figure 2 was taken from a distance of 50 feet and the two men at this distance are clearly visible. The man on the left is wearing the safety vest and reflective gloves, and a strip of silver white reflectorized fabric is sewn to each trouser leg. In figure 3, the man on the right is only partially visible from a distance of 100 feet while the man wearing the reflectorized clothing is highly visible. Figure 4 was taken from 150 feet. From this distance, we have lost the man with the nonreflective clothing. But even when photographed from 250 feet, the man wearing the reflective clothing could still be seen.

These photographs speak for themselves and show the need for some type of illumination to prevent mishaps on the flight line at night.




USAAAVS, IN conjunction with agencies from Ft. Rucker and Ft. Bragg, and with assistance from the Navy, recently evaluated a glowing chemical light for marking aerial gunnery range boundaries and targets at night. This evaluation arose from the need to provide safe, adequate and inexpensive illumination on and around aerial gunnery ranges during night training.

The chemical light marker used for this test is a sealed nylon tube, housing two liquids, one contained in a glass vial. Flexing the nylon tube to break the enclosed vial and then vigorously shaking the tube instantly produces a bright yellow-green light. The light is intense enough to read by and radiates in all directions. It is a convenient, safe and reliable low-intensity light source. It does not produce flame or heat, does not emit fumes and does not depend on electrical current or radioactivity to function. It may be used safely in explosive atmospheres and is equally effective under water and in wind and rain. If the tube is not punctured or otherwise opened, the light is distinctly visible for 3 to 12 hours depending on the ambient temperature.

Additional features include a shelf life of about 2 years at temperatures not exceeding 125 degrees F., an ability to float on water and a weight of approximately 1 ounce. One end of the tube is designed so it can be attached to objects by string, cord, nails, etc. Different types are available which produce yellow, orange or green lights of varying intensity and duration.

A chemiluminescent paste which is in the federal supply system was also used in conjunction with the chemical light, but proved to be ineffective during the test because of the short illumination time (approximately 45 minutes) and the inability to be seen beyond 200 meters.

For the night exercises, an arrow was made by nailing the lights onto the asphalt surface to align

**FIGURE 1**
Night view of alignment arrows marked with chemical lights and paste

two parking helipads and the first rearming point as shown in figure 1. The four lights arranged in a line were spaced 4 feet apart and the other two lights were placed at a 45-degree angle approximately 3 feet from the first light forming the arrow. The helipad to the left of the lighted arrow was marked with the chemiluminescent paste directly onto the helipad surface. Chemical lights were also placed on the rear, top and inside front of the ammunition ready racks to illuminate the helipads as shown in figure 2.

Armored personnel carriers were used for targets (figure 3). The left target, which was positioned 1,000 meters from the start fire line, was marked with chemiluminescent paste, while the right 1,000-meter target was marked with both the paste and chemical lights. The two 1,500-meter targets which also served partially as the cease fire line were marked only with the chemical lights. In addition, boundary and cease fire line markers made from 1- by 4-inch board and which stood 4 feet high contained different lighting configurations.

Firing was conducted with and without artificial

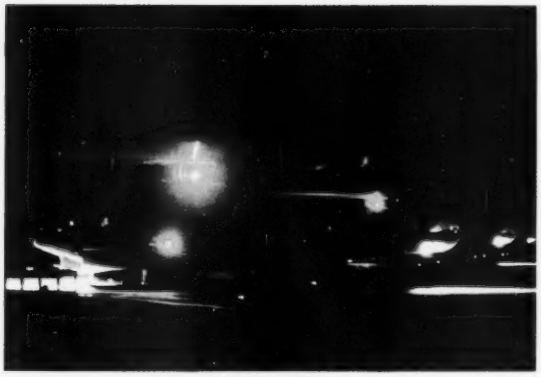


**FIGURE 2**
Ammunition ready racks illuminated by chemical lights

**FIGURE 3**
Illuminated target array

illumination for 4 hours, and the chemical lights were still visible at the end of this exercise.

This test revealed that pilots and copilots/gunners successfully engaged the chemically illuminated targets from 1,800 to 1,000 feet agl or less and that the lights could also be seen from the surface to an altitude of 2,400 feet agl by support mission aviators. Pilots flying maintenance support aircraft successfully used the lights to locate the range, establish an approach and land on the parking helipad. The chemical light was also used on-site by armor and maintenance personnel and provided sufficient lighting for the performance of their duties.

Although this evaluation demonstrated that the chemical light can be used safely and effectively for night aerial gunnery training, it is being considered for further evaluation. Should the light be adopted by the Army in the future, a variety of uses is forseeable for ground and airmobile operations.

# Supervision + Safety = A Winning Team

USAAAVS

THIS MONTH USAAAVS launches a new 6-month safety promotion as a continuing tie-in with the 3-year federal "Freedom and Safety Thru 76" program.

Our new theme "Supervision + Safety = A Winning Team" will focus on the importance of the supervisor's role in accident prevention. This is a follow-on to our "Take a Minute" and "Pros Do It Right" promotions during the past fiscal year. These programs were enthusiastically accepted and helped to reduce our accident rate for FY 75 to less than seven accidents per 100,000 flying hours—the lowest rate in the history of Army aviation.

But even with this low rate, there still is room for improvement. This campaign is aimed at supervisors because, no matter what aviation job is being performed, that's where safety has to begin.

Aviation personnel see their supervisor on a one-to-one basis. To them, he is Army aviation supervision. His attitude toward safety, his influence and the standards he establishes through his own example are the keys to greater gains in aviation safety.

Accident experience shows that where aviation personnel have not had the benefit of a supervisor who knows and accepts his safety responsibility, human error may well be supervisory error.

The idea of the campaign is to make every member of the aviation team, particularly supervisors, aware of their safety responsibility.

During the coming months we will publish articles which look at supervision and safety from many different angles. We hope these will show you that supervision and safety must go hand-in-hand to produce a winning team.

The slogan "Supervision + Safety = A Winning Team" will be displayed on posters, auto bumper stickers and decals which will be distributed worldwide this month.

# METROPOLITAN AREA FLYING

LET'S LOOK AT two examples of two different UH-1 crews on different flight plans. There's a big difference. One crew is about to make a mistake that could result in a violation being filed against them by the FAA. See if you can catch the crew in error.

Example No. 1: The first UH-1, on a routine VFR flight, is cruising the Chicago area, not really paying too much attention to its whereabouts. The pilots casually glance at the ground and find they are smack over the center of the world's busiest airport, Chicago O'Hare.

Example No. 2: This pair of aviators chose to file IFR. If you are on an IFR flight plan it is the controller's responsibility to keep you clean. "Army 12345, Chicago Center has you on radar contact, 20 miles southwest of O'Hare Field, climb, maintain 5,000, over." The pilot calmly rogers these instructions and makes his climb to 5,000 feet.

The violation has occurred. Have you caught the crew in error? Before we answer this question, let's talk a little about metropolitan area flying.

How many of us have flown into Chicago's O'Hare Airport? How about the John F. Kennedy Airport in New York? How about the rest of the major metropolitan areas classified as Group I or Group II Terminal Control Areas (TCA)?

If my guess is right, less than 10 percent of us have ever flown in this type environment.

The point I am trying to make is that just as NOE (nap-of-the-earth) requires special training, so does metropolitan area flying. Certainly there is a huge difference in training between the two, but the aviator who tries to fly in a Group I TCA without any indoctrination can be as dangerous as the non-NOE trained pilot attempting to fly NOE.

Now, back to our problem. If you felt the IFR crew was in the right, I suggest you read FAR 91.24 which says that no aircraft may penetrate a Group I TCA unless that aircraft has encoding altimeter capabilities. As most of the Army's UH-1s have not been so modified, this IFR crew was in violation of FAR 91.24 as soon as their aircraft penetrated the TCA. Even though the controller knows you do not have the proper altimeter, and even though he gave you the clearance, it is the pilot's responsibility to stay out of the TCA if he does not have this equipment. There are exceptions to this FAR, and these are also found in FAR 91.24.

Next our VFR crew. If you guessed they were in the wrong, you were mistaken. If you'll look at your DOD Flip information you will find that you are permitted to fly directly over the center of Chicago O'Hare as long as your altitude is about 7,000 feet.

It's important to understand what the TCA can mean in relation to aircraft traffic density. Very basically, think of the TCA as looking similar to an upside down wedding cake. Looking at the cake upside down, the top, or the cake's original bottom, is flat. As long as you stay above the altitude depicted for this top section, you will be clear, above the TCA. A problem develops, however, as aircraft approach the Chicago area for a landing at one of Chicago's many small, outlying airports. As you get closer to the city, the layers of the cake get closer to ground level, until approximately 5 miles from O'Hare, the TCA goes all the way to the ground. This forces all inbound aircraft lower and lower and effectively reduces the usable airspace near the city to the appropriate 1,400 feet beneath the TCA. Obviously your chances for a midair collision, especially around a VOR, are greatly increased in this environment.

Another problem is ozone. Many of the larger industrial cities have a phenomenon called ozone, which is a haze condition caused by automobile exhaust fumes coupled with a warm outside temperature. Ozone limits visibility to 3 to 6 miles on a normal day. The significance of ozone to the average, nonaviator is one of caution. Moving about outdoors could cause serious breathing problems, especially for those individuals already hampered with respiratory ailments. To the aviator ozone means that due to restricted visibility, a crew could stumble unknowingly into a major airport's control zone, perhaps within 3 miles of an airport before having visual contact with the airport.

Some airport personnel would forgive you for this, but what if you had a need to land at Chicago O'Hare? When O'Hare tower clears you into the control zone they will expect you to know something about the airport layout. You may be told to come into the airport staying between runways 9R and 9L. Not too simple when you can't even see the airport until you are within 3 miles because of the ozone.

Of course, there are many other items to consider. Forced landing area visibility and noise abatement are two big ones. Perhaps at your next aviation safety meeting you could have an individual who's flown in this environment tell you of some of his experiences. And units commonly flying into metropolitan areas should include appropriate training in their training programs. In this way, you may avoid a situation which could be very embarrassing or very hazardous when flying around large metropolitan areas.

USAAAVS

*If you have a question about personal equipment or rescue/survival gear, write Pearl, USAAAVS, Ft. Rucker, AL 36360*

# PEARL'S

Personal Equipment & Rescue/Survival Lowdown

**First-Aid Kit Seal**

Some individuals have been using steel safety wire to seal their first-aid kits. This may be great until you need to get into the kit in an emergency. There is a seal, NSN 5340-00-391-4240, available which comes with a strand of copper wire and can be broken easily to gain access to the kit components.

**Signal Kits**

*Reference is made to the pen flares issued with the survival vest, NSN 8365-00-177-4819. After a recent ferry flight to turn in an aircraft to an overhaul facility, my crew had to return to the unit by civilian airline. Before we could put our baggage aboard, we had to turn in all flares. As there were eight of us, this means we all have to reorder these flares, at some expense to either the individual or the unit.*

*Was the airline correct to require us to turn these in? How dangerous are these flares when flown in the baggage area of a commercial airline?*

*If we are required to wear these survival vests on all cross-country flights, who has to pay for reordering the flares?*

The signal kit, foliage, penetrating flare is listed as a restricted article by the Department of Transportation Code of Federal Regulations, Title 49, parts 172 and 173. Federal Aviation Regulation, parts 121 and 135, prohibits passengers from carrying deadly or dangerous weapons or restricted items aboard aircraft operated by commercial airlines. In view of this, the airline was correct in disallowing shipment of the flares.

Mr. Sherwood Allen, FAA hazardous materials specialist, Air Carrier Branch, FAA Southern Regional Office, Atlanta, GA, was contacted concerning the flare problem. He has written Department of Transportation (DOT) requesting consideration and the possibility of removing the flare from the Department of Transportation restricted article list. You will be advised of the DOT decision when this Agency is notified.

Until a decision is reached, USAAAVS recommends aviation crewmembers continue to carry the signal kit while participating in military aerial flights. The kits can be shipped by commercial surface transportation throughout the United States. It is recommended the ferry flight commanders be made aware of requirements to ship the signal kit, foliage, penetrating, by surface transportation.

The signal kit is a component of the individual survival kit, vest type (SRU-21/P). Replacement signal kits should be requisitioned through normal supply channels using unit stock funds.

**Flight Clothing and Survival Equipment**

*Do fabric softeners affect the flame retardant characteristics of Nomex?*

*Has anything been done to seal the gap between the Nomex glove and the Nomex uniform's cuff [i.e., a velcro fastener]?*

*Does the Army have any sort of overwater survival course besides the one in current use in Japan?*

*Our unit has had considerable difficulty acquiring survival vests. Our first requisitions were canceled due to a change or error in the stock number used. Our current requisition is several months old and is still unfilled. The environment in which we operate is extreme and demands the highest degree of determination and ingenuity in a survival situation. Although we routinely carry survival gear aboard the aircraft, it is bulky and is secured in the cabin. In the event a crewmember is unable to recover his equipment, his chance of survival would greatly diminish without the aid of the items he could carry on his person with the vest.*

*Is there some way to speed the acquisition of the survival vests? Do you have items designed for the vest to be used in the arctic or specific recommendations for items to be carried?*

Commercial fabric softeners do not affect the fire retardant capabilities of the high temperature resistant nylon twill OG-106 flight uniform (Nomex). However, starch and bleach degrade the fire retardancy and should not be used in laundering the uniform.

The separation between Nomex shirt and Nomex gloves experienced by aviation crewmembers has been corrected by increasing the shirt sleeve length and the glove gauntlet. The changes were a result of Equipment Improvement Recommendations.

Water survival training for aircrewmembers is directed by and the responsibility of the major commands. It is not unusual for major commands to arrange for their training to be done by either the U.S. Navy or Air Force.

The increased demand for life support and survival equipment has resulted in some shortages, including survival radios and survival vests. It is hoped that sufficient equipment will soon be available to fill all outstanding requisitions. USAAAVS recommends that all of your outstanding requisitions for life support equipment items be verified and validity established. Survival vests are shipped in accordance with the priority designated on your requisition.

The survival vest was designed for use in a tropical environment. However, many of the vest components apply to all survival situations. USAAAVS recommends you consider carrying survival kit, individual, cold climate, LIN U74412, described and authorized in Common Table of Allowances 50-900, dated 15 October 1973. This survival kit is intended for use by aviation personnel exposed to emergency situations in remote and isolated temperate, subarctic and arctic areas.

# USAASO Sez

## The U. S. Army Aeronautical Services Office discusses

### Changes To FAR, Part 91

ATTENTION ALL throttle benders! The Federal Aviation Administration (FAA) has made several changes to FAR Part 91 pertaining to Safe Altitude Maintenance.

FAR 91.75(a) has been amended to include, "If a pilot is uncertain of the meaning of an ATC clearance, he shall immediately request clarification from ATC." So it could be said, "If you don't understand, don't do; ask."

The title of subparagraph FAR 91.116(f) has been changed as follows: "Operation on Unpublished Routes and Use of Radar in Instrument Approach Procedures." The greatest impact to this subparagraph occurs after the third sentence with the addition of the following verbage which reads, "When operating on an unpublished route or while being radar vectored, the pilot, when an approach clearance is received, shall, in addition to complying with FAR 91.119, maintain his last assigned altitude unless (1) a different altitude is assigned by ATC, or (2) until the aircraft is established on a segment of a published route or instrument approach procedure. After the aircraft is so established, published altitudes apply to descent within each succeeding route or approach segment unless a different altitude is assigned by ATC." The verb "may" has been used to replace the verb "will" in the last sentence of this subparagraph. Now the last sentence reads, "Upon reaching the final approach fix or position, the pilot MAY either complete his instrument approach in accordance with the procedure approved for the facility, or MAY continue a surveillance or precision radar approach to a landing."

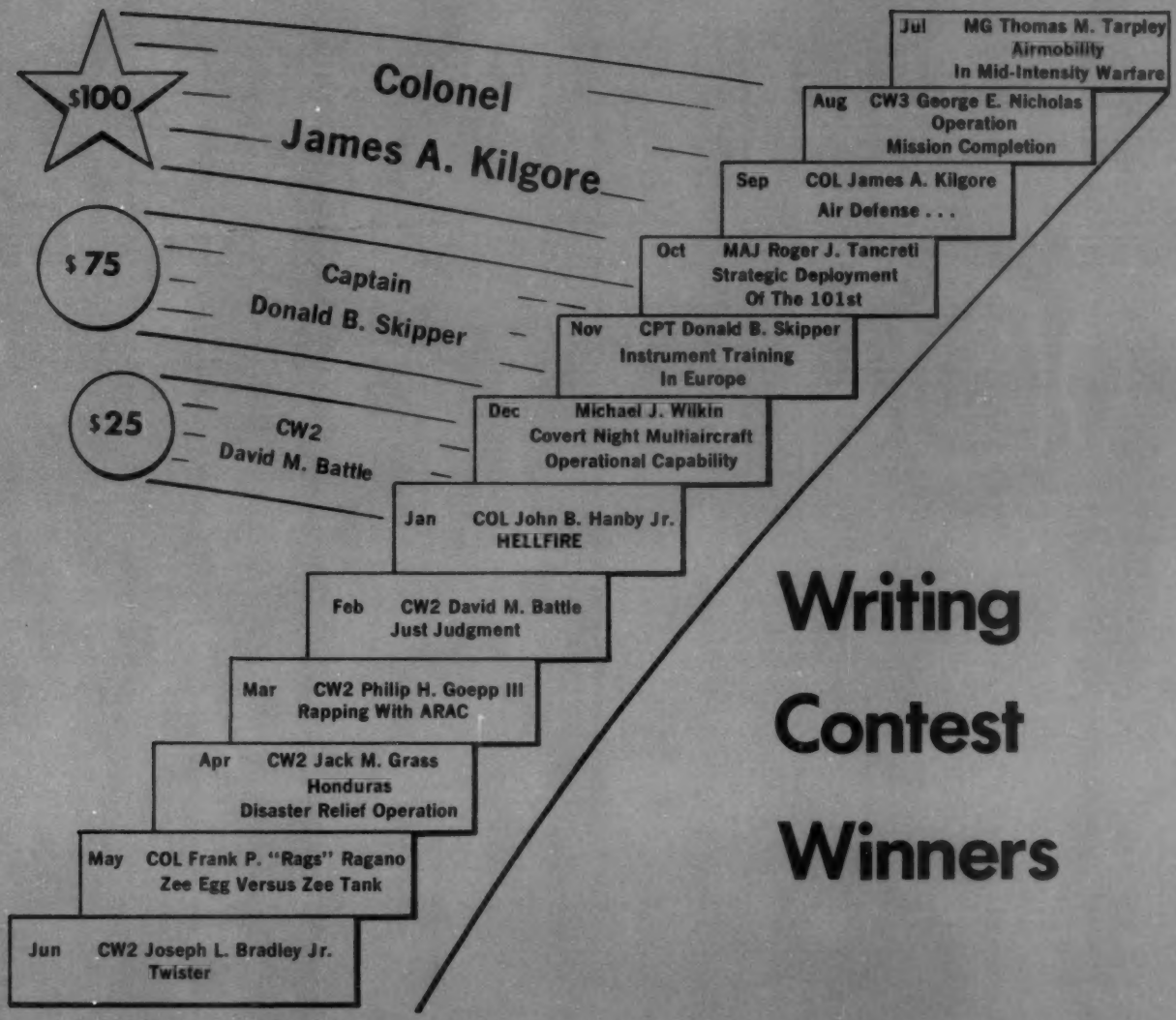
In summary, if an ATC clearance is not understood, ask the controller for clarification. If you are operating under IFR conditions on uncharted routes or being radar vectored and receive an approach clearance, maintain the last assigned altitude unless assigned a new altitude by ATC or until the aircraft is established on a segment of a published route or instrument approach procedure. The requirements of FAR 91.119 and Parts 95 and 97 are re-emphasized; that an aircraft on such a segment is subject to FAA published minimum altitudes applicable to descent within each succeeding segment or route or instrument approach procedure unless another altitude is assigned by ATC.

*USASSO Sez: The smart aviator is the one who asks questions when in doubt!*

### Maintenance Test Flight Course (CH-47) Graduates

A major change to the CH-47 Test Flight handbook is being printed and is to be available to CH-47 Test Flight graduates on about the 15th of this month. If you are a graduate of this course and want to receive these changes, send your current unit address or permanent home address to:

Director
Aviation Maintenance Training Department
Test Flight Division
ATTN: CH-47 Track
Fort Eustis, VA 23604


$100
Colonel
James A. Kilgore
$75
Captain
Donald B. Skipper
$25
CW2
David M. Battle
Jul MG Thomas M. Tarpley Airmobility In Mid-Intensity Warfare
Aug CW3 George E. Nicholas Operation Mission Completion
Sep COL James A. Kilgore Air Defense . . .
Oct MAJ Roger J. Tancreti Strategic Deployment Of The 101st
Nov CPT Donald B. Skipper Instrument Training In Europe
Dec Michael J. Wilkin Covert Night Multiaircraft Operational Capability
Jan COL John B. Hanby Jr. HELLFIRE
Feb CW2 David M. Battle Just Judgment
Mar CW2 Philip H. Goepp III Rapping With ARAC
Apr CW2 Jack M. Grass Honduras Disaster Relief Operation
May COL Frank P. "Rags" Ragano Zee Egg Versus Zee Tank
Jun CW2 Joseph L. Bradley Jr. Twister

# Writing Contest Winners

**YOU COULD BE a winner if you submit an article to the AVIATION DIGEST's fifteenth annual writing contest beginning this month. The first place monthly winner will receive a certificate plus a $25.00 U. S. Savings Bond. The DIGEST also recognizes a second place monthly winner who will be awarded a certificate. A person who does not place first or second will receive credit in his 201 file plus a certificate signifying that he has had an article published in the DIGEST. Three annual award winners will be selected from the monthly first place winners. The best of the year will receive a bronze plaque plus a $100 Savings Bond. Second place receives a $75.00 bond and a certificate and third place a $25.00 bond and a certificate.**

**To be eligible an article must be original and concern Army aviation or related subjects. Dual authored articles are not eligible for the contest, but can be selected for publication.**

**Winning articles are selected by judges who review the manuscripts without bylines. Selection is based on accuracy, completeness, originality, readability, soundness, substance and overall merit.**

**Authors should include pictures, diagrams or charts available or necessary to illustrate manuscripts. Your articles should be submitted to: Editor, U. S. ARMY AVIATION DIGEST, P. O. Drawer P, Fort Rucker, AL 36360.**

# NEW NOMEX JACKET

This is the eleventh of 12 back covers designed to show personal survival, rescue and protective equipment. Detach this cover for your bulletin board display of the more important survival and protective equipment available to crewmembers.

11 USAAAVS OF 12

Pearl models the new Standard LCC A Flyer's Jacket developed to be worn with the summer flight uniform in a +40° F. cockpit/cabin environment. This jacket, available in light- or mediumweight material, replaces the nylon jacket which has been reclassified as Standard LCC B.

The lightweight jacket has two layers of 6-ounce oxford cloth and is flame resistant and antistatic treated. The mediumweight jacket has one layer of 6-ounce oxford cloth and is flame resistant and antistatic treated. It is lined with 10-ounce flame-resistant quilted batting.

Both jackets have knitted cuffs and waistbands, slash side pockets, conventional collar, slide fastener front opening and a pencil/cigarette pocket on the upper left sleeve. They are olive green and match the color of the flight uniform. The lightweight jacket weighs 1 lb. 7.5 oz. and the mediumweight weighs 2 lb. 5 oz. The jackets, authorized in accordance with Common Table of Allowances 50-900, are available in the following sizes.

| SIZE | LIGHTWEIGHT | MEDIUMWEIGHT |
|---|---|---|
| Extra small–short | NSN 8415-00-217-7201 | NSN 8415-00-221-8870 |
| Extra small–regular | NSN 8415-00-217-7207 | NSN 8415-00-221-8873 |
| Extra small–long | NSN 8415-00-217-7208 | NSN 8415-00-221-8874 |
| Small–short | NSN 8415-00-217-7210 | NSN 8415-00-221-8879 |
| Small–regular | NSN 8415-00-217-7212 | NSN 8415-00-221-8884 |
| Small–long | NSN 8415-00-217-7213 | NSN 8415-00-221-8886 |
| Medium–short | NSN 8415-00-217-7219 | NSN 8415-00-221-8920 |
| Medium–regular | NSN 8415-00-217-7220 | NSN 8415-00-217-7387 |
| Medium–long | NSN 8415-00-217-7221 | NSN 8415-00-217-7391 |
| Large–short | NSN 8415-00-217-7226 | NSN 8415-00-217-7400 |
| Large–regular | NSN 8415-00-217-7229 | NSN 8415-00-217-7401 |
| Large–long | NSN 8415-00-217-7233 | NSN 8415-00-217-7402 |
| Extra large–short | NSN 8415-00-217-7234 | NSN 8415-00-217-7422 |
| Extra large–regular | NSN 8415-00-217-7235 | NSN 8415-00-217-7423 |
| Extra large–long | NSN 8415-00-217-7236 | NSN 8415-00-217-7424 |